แบบสอบถามสถานะโครงการภายใต้กลไกการพัฒนาที่สะอาด

ผู้ตอบแบบสอบถาม _____

ตำแหน่ง _____วันที่ _____

1. ชื่อโครงการ _____

2. ประเภทโครงการ (โปรดเลือก)

    2.1 โครงการผลิตกระแสไฟฟ้าจากก๊าซชีวภาพ   O
    2.2 โครงการผลิตกระแสไฟฟ้าจากเชื้อเพลิงชีวภาพ   O
    2.3 โครงการผลิตกักเก็บมีเทนจากหลุมฝังกลบขยะ   O
    2.4 โครงการอื่นๆ   O   (โปรดระบุ) _____

3. เอกสารโครงการที่เกี่ยวข้อง (โปรดเลือก)

    3.1 Project Idea Note (PIN)   O
    3.2 Project Design Document (PDD)   O
    3.3 รายงานการประเมินผลกระทบสิ่งแวดล้อมเบื้องต้น (IEE)   O
    3.4 รายงานการวิเคราะห์ผลกระทบสิ่งแวดล้อม (EIA)   O
    3.5 CDM Project Prevalidation Report   O
    3.6 เอกสารอื่นๆ   O   (โปรดระบุ) _____

4. การดำเนินงานที่ผ่านมา (โปรดตอบคำถาม)

    4.1 จัดทำ Project Idea Note (PIN)   วัน_____ เดือน_____ ปี_____
         แล้วเสร็จ
    4.2 จัดทำ Project Design Document   วัน_____ เดือน_____ ปี_____
         (PDD) แล้วเสร็จ
    4.3 วันที่ Meth Panel รับรอง Methodology   วัน_____ เดือน_____ ปี_____
         ของโครงการ
    4.4 วันที่ Validator   วัน_____ เดือน_____ ปี_____
         เริ่มตรวจสอบโครงการในพื้นที่
    4.5 วันที่เริ่มโครงการ (ติดตั้งระบบ)   วัน_____ เดือน_____ ปี_____
    4.6 วันที่เริ่มเดินระบบ   วัน_____ เดือน_____ ปี_____
    4.7 วันที่เริ่มมีการลดก๊าซเรือนกระจก   วัน_____ เดือน_____ ปี_____

5. ผู้มีส่วนเกี่ยวข้องกับโครงการภายใต้กลไกการพัฒนาที่สะอาด (โปรดระบุ)

    5.1 เจ้าของโครงการ   _____
    5.2 เจ้าของโครงการร่วม 1 (หากมี)   _____
    5.3 เจ้าของโครงการร่วม 2 (หากมี)   _____
    5.4 DOE (Validator)   _____
    5.5 ผู้รับซื้อ CER   _____

6. รายละเอียดของโครงการ (โปรดระบุ)

    6.1 ที่ตั้งโครงการ _____
    6.2 Methodology ที่ใช้ _____
    6.3 ปริมาณก๊าซเรือนกระจกที่ลดได้ในแต่ละปี _____ ตัน
    6.4 ปริมาณก๊าซเรือนกระจกที่ได้ลดลงแล้วตั้งแต่เริ่มโครงการจนถึงปัจจุบัน _____ ตัน

หลักเกณฑ์การพัฒนาที่ยั่งยืนสำหรับโครงการกลไกการพัฒนาที่สะอาด

1. หลักการและเหตุผล

ปัญหาการเปลี่ยนแปลงสภาพภูมิอากาศเป็นปัญหาร่วมกันระหว่างประเทศต่างๆ โดยสาเหตุส่วนหนึ่งมาจากกิจกรรมของมนุษย์ในการปล่อยก๊าซเรือนกระจกสู่บรรยากาศ ปัญหานี้ได้รับความสนใจและหวั่นวิตกว่าอาจจะเกิดผลกระทบรุนแรง ทำให้เป็นหน้าที่เร่งด่วนของประชาคมโลกในการร่วมกันแก้ปัญหา แนวทางหนึ่งคือ การให้สัตยาบันต่ออนุสัญญาสหประชาชาติว่าด้วยการเปลี่ยนแปลงสภาพภูมิอากาศ (United Nations Framework Convention on Climate Change - UNFCCC) โดยอนุสัญญาฯ ฉบับนี้ได้กล่าวถึงข้อผูกพันของกลุ่มประเทศในภาคผนวกที่ 1 (Annex I) ซึ่งเป็นประเทศที่พัฒนาแล้ว และมีพันธกรณีในการลดปริมาณก๊าซเรือนกระจก โดยได้เพิ่มความเข้มข้นของพันธกรณีผ่านพิธีสารเกียวโต (Kyoto Protocol) ซึ่งกำหนดให้มีข้อผูกพันทางกฎหมายเพื่อให้บรรลุเป้าหมายของอนุสัญญาฯ โดยมีกลไกการพัฒนาที่สะอาด หรือ Clean Development Mechanism: CDM เป็นกลไกเดียวภายใต้พิธีสารเกียวโตที่ให้ประเทศพัฒนาแล้วสามารถดำเนินการร่วมกับประเทศกำลังพัฒนานอกภาคผนวก 1 (Non Annex I) เพื่อให้เกิดการลงทุนของประเทศพัฒนาแล้วในประเทศกำลังพัฒนา ในการดำเนินกิจกรรมที่มีส่วนร่วมในการลดปริมาณการปล่อยก๊าซเรือนกระจกและส่งเสริมให้เกิดการพัฒนาที่ยั่งยืน ทั้งนี้ เพื่อสร้างแรงจูงใจให้กับประเทศที่พัฒนาแล้วสามารถลดปริมาณก๊าซเรือนกระจกได้โดยมีต้นทุนในการลดที่ต่ำลง และส่งเสริมให้ประเทศกำลังพัฒนาได้มีส่วนร่วมในการแก้ไขปัญหาภาวะโลกร้อน ประเทศไทยถือได้ว่าเป็นประเทศที่อยู่ในข่ายที่ได้รับความสนใจจากประเทศพัฒนาแล้วหลายประเทศเพื่อร่วมดำเนินโครงการ CDM เนื่องจากไทยเป็นประเทศหนึ่งที่มีศักยภาพทั้งในเชิงเศรษฐกิจ สังคมและการเมือง ดังนั้น จึงจำเป็นอย่างยิ่งที่ประเทศไทยต้องมีหลักเกณฑ์ต่างๆ ที่เกี่ยวข้องสำหรับการดำเนินงานโครงการ CDM เพื่อให้การดำเนินงานต่างๆ เกิดประโยชน์สูงสุดต่อประเทศชาติและส่วนรวม

หลักเกณฑ์การพัฒนาที่ยั่งยืนสำหรับโครงการกลไกการพัฒนาที่สะอาดในประเทศไทยประกอบด้วยมิติการพัฒนาที่ยั่งยืน 4 ด้านคือ ด้านทรัพยากรธรรมชาติและสิ่งแวดล้อม ด้านสังคม ด้านการพัฒนาและ/หรือการถ่ายทอดเทคโนโลยี และด้านเศรษฐกิจ ซึ่งหลักเกณฑ์ที่กำหนดขึ้นนี้ใช้สำหรับการพิจารณาโครงการกลไกการพัฒนาที่สะอาดที่เกี่ยวเนื่องกับพลังงาน ได้แก่

- โครงการด้านการผลิตและใช้พลังงาน เช่น การผลิตพลังงานหมุนเวียน และปรับปรุงประสิทธิภาพการใช้พลังงาน
- โครงการด้านสิ่งแวดล้อมเกี่ยวเนื่องกับพลังงาน เช่น การแปลงขยะและน้ำเสียเป็นพลังงาน
- โครงการด้านคมนาคมขนส่งเกี่ยวเนื่องกับพลังงาน เช่น การเพิ่มประสิทธิภาพระบบคมนาคมขนส่ง
- โครงการด้านอุตสาหกรรมเกี่ยวเนื่องกับพลังงาน เช่น การลดการปล่อยก๊าซเรือนกระจกในกระบวนการอุตสาหกรรม

2. หลักเกณฑ์การประเมินโครงการ แบ่งออกเป็น 3 กรณี คือ

กรณีที่ 1 – ใช้ประเมินโครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM โดยพิจารณาจากเอกสารโครงการที่ผู้พัฒนาโครงการเสนอ (Project Design Document: PDD)

กรณีที่ 2 – ใช้ประเมินโครงการที่ได้เริ่มดำเนินการแล้ว และยื่นขอความเห็นชอบเป็นโครงการ CDM

กรณีที่ 3 – ใช้ประเมินเพื่อติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว (หลักเกณฑ์กรณีที่ 3 นี้ อาจมีการปรับปรุงรายละเอียดเพิ่มเติมในอนาคตได้ตามความเหมาะสม)

3. การให้คะแนน

ในการพิจารณากำหนดดัชนีวัดและการให้คะแนนแต่ละดัชนีภายใต้หลักเกณฑ์ที่กำหนด ได้มีการศึกษาเปรียบเทียบกับหลักเกณฑ์ของประเทศต่างๆ รวมทั้ง Gold Standard ที่พัฒนาโดยองค์การกองทุนสัตว์ป่าโลกสากล (WWF) ซึ่งได้รับการยอมรับอย่างแพร่หลายว่าเป็นหลักเกณฑ์การพิจารณาที่มีความเหมาะสม และมีบางประเทศได้นำหลักเกณฑ์ดังกล่าวมาใช้ในการพิจารณาโครงการ CDM แล้ว หลักเกณฑ์ดังกล่าวเป็นการเปรียบเทียบโครงการกับกรณีฐานหรือกรณีไม่มีโครงการ ดังนั้น สำหรับประเทศไทยเพื่อให้การพิจารณาประเมินแต่ละดัชนีภายใต้หลักเกณฑ์ที่กำหนดมีประสิทธิภาพในระดับสากล และมีความเป็นไปได้ในทางปฏิบัติ จึงควรมีการให้คะแนน ดังนี้

คะแนนที่มากกว่า 0 หมายถึง กิจกรรมของโครงการในส่วนที่เกี่ยวข้องกับดัชนีนี้ **สามารถทำได้ดีกว่าเกณฑ์ที่มาตรฐานกำหนดไว้** ซึ่งบ่งชี้การพัฒนาที่ยั่งยืนตามหลักเกณฑ์การพัฒนาที่ยั่งยืนสำหรับโครงการกลไกการพัฒนาที่สะอาด

คะแนนที่เท่ากับ 0 หมายถึง กิจกรรมของโครงการในส่วนที่เกี่ยวข้องกับดัชนีนี้ **ทำได้เทียบเท่ากับเกณฑ์ที่มาตรฐานกำหนดไว้** ซึ่งไม่ก่อให้เกิดผลกระทบทั้งทางบวกและทางลบต่อการพัฒนาที่ยั่งยืนตามหลักเกณฑ์การพัฒนาที่ยั่งยืนสำหรับโครงการกลไกการพัฒนาที่สะอาด

คะแนนที่น้อยกว่า 0 หมายถึง กิจกรรมของโครงการในส่วนที่เกี่ยวข้องกับดัชนีนี้ **ทำได้ต่ำกว่าเกณฑ์ที่มาตรฐานกำหนดไว้** ซึ่งบ่งชี้ว่าก่อให้เกิดผลกระทบในทางลบต่อการพัฒนาที่ยั่งยืนตามหลักเกณฑ์การพัฒนาที่ยั่งยืนสำหรับโครงการกลไกการพัฒนาที่สะอาด

"ไม่เกี่ยวข้อง" หมายถึง กิจกรรมของโครงการ **ไม่มีการดำเนินงานที่เกี่ยวข้องกับดัชนีนี้**

โครงการที่ผ่านหลักเกณฑ์จะต้องได้ **"ผลคะแนนรวมทั้งหมดเป็นบวก"** และ **"คะแนนรวมของแต่ละหมวดดัชนีจะต้องเป็นบวก"** ด้วย ซึ่งหมายความว่า **โครงการนั้นมีการบ่งชี้ที่ดีว่าก่อให้เกิดการพัฒนาที่ยั่งยืนในพื้นที่**

4. หลักเกณฑ์การพัฒนาที่ยั่งยืนสำหรับพิจารณาโครงการกลไกการพัฒนาที่สะอาด โดยสรุปประกอบด้วย

4.1 หมวดดัชนีด้านทรัพยากรธรรมชาติและสิ่งแวดล้อม

4.1.1 ดัชนีด้านสิ่งแวดล้อม

1) ลดการปล่อยก๊าซเรือนกระจกที่กำหนดโดยพิธีสารเกียวโตของโครงการ

2) ลดการปล่อยสารที่เป็นมลพิษทางอากาศตามประกาศมาตรฐานมลพิษทางอากาศ

3) มลพิษทางเสียง

4) การจัดการมลพิษทางกลิ่น

5) ปริมาณความสกปรกในน้ำทิ้ง

6) การจัดการของเสียของโครงการ

7) มลพิษดิน

8) การปนเปื้อนของน้ำใต้ดิน

9) การลดปริมาณของเสียอันตราย

4.1.2 ดัชนีด้านทรัพยากรธรรมชาติ

10) ความต้องการใช้น้ำ และประสิทธิภาพการใช้น้ำของโครงการ

11) การพังทลายของดิน และการกัดเซาะชายฝั่ง/ ชายตลิ่งของแม่น้ำ

12) การเพิ่มพื้นที่สีเขียวภายใต้โครงการ

13) ความหลากหลายของระบบนิเวศ (ecosystem diversity)

14) ความหลากหลายของชนิดพันธุ์ (species diversity)

15) การใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรม (GMO) และ/หรือสัตว์ต่างถิ่น (alien species) ในบริเวณพื้นที่โครงการ

4.2 หมวดดัชนีด้านสังคม

1) การมีส่วนร่วมของประชาชน

2) สนับสนุนกิจกรรมพัฒนาสังคม วัฒนธรรม และแนวทางปรัชญาเศรษฐกิจพอเพียง

3) สุขภาพอนามัยของคนงานและชุมชนโดยรอบ

4.3 หมวดดัชนีด้านการพัฒนาและ/หรือการถ่ายทอดเทคโนโลยี

1) การพัฒนาเทคโนโลยี

2) แผนการดำเนินงานเมื่อสิ้นสุดระยะเวลา Crediting Period ที่โครงการเลือกไว้

3) การฝึกอบรมบุคลากร

4.4 หมวดดัชนีด้านเศรษฐกิจ

1) รายได้ที่เพิ่มขึ้นของผู้มีส่วนได้ส่วนเสีย

    1.1) รายได้ที่เพิ่มขึ้นของคนงาน

    1.2) รายได้ที่เพิ่มขึ้นของผู้มีส่วนได้ส่วนเสียอื่น

2) พลังงาน

    2.1) การใช้พลังงานทดแทน

    2.2) ประสิทธิภาพการใช้พลังงาน

3) การเพิ่มการใช้วัตถุดิบภายในประเทศ

หลักเกณฑ์การพัฒนาที่ยั่งยืนสำหรับพิจารณาโครงการกลไกการพัฒนาที่สะอาดในประเทศไทย

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
1. หมวดดัชนีด้านทรัพยากรธรรมชาติและสิ่งแวดล้อม				
ดัชนีด้านสิ่งแวดล้อม				
1) ลดการปล่อยก๊าซเรือนกระจกที่กำหนดโดยพิธีสารเกียวโตของโครงการ หมายเหตุ : ก๊าซเรือนกระจกที่กำหนดโดยพิธีสารเกียวโตได้แก่ - คาร์บอนไดออกไซด์ (CO_2) - มีเทน (CH_4) - ไนตรัสออกไซด์ (N_2O) - ไฮโดรฟลูออโรคาร์บอน (HFCs) - เปอร์ฟลูออโรคาร์บอน (PCs) - ซัลเฟอร์เฮกซาฟลูออไรด์ (SF_6)	ปริมาณการปล่อยก๊าซเรือนกระจกเทียบเท่าคาร์บอนไดออกไซด์ (CO_2 equivalent) โดยเทียบกับเส้นฐาน (baseline)	0 ปริมาณการปล่อยก๊าซเรือนกระจก**เท่าเดิม** +1 ปริมาณการปล่อยก๊าซเรือนกระจก**ลดลง**	- 1 ปริมาณการปล่อยก๊าซเรือนกระจก**เพิ่มขึ้น** 0 ปริมาณการปล่อยก๊าซเรือนกระจก**เท่าเดิม** +1 ปริมาณการปล่อยก๊าซเรือนกระจก**ลดลงน้อยกว่า**ร้อยละ 10 +2 ปริมาณการปล่อยก๊าซเรือนกระจก**ลดลงตั้งแต่**ร้อยละ 10	- 1 ปริมาณการปล่อยก๊าซเรือนกระจก**เพิ่มขึ้น** 0 ปริมาณการปล่อยก๊าซเรือนกระจก**เท่าเดิม** +1 ปริมาณการปล่อยก๊าซเรือนกระจก**ลดลงน้อยกว่า**ร้อยละ 10 +2 ปริมาณการปล่อยก๊าซเรือนกระจก**ลดลงตั้งแต่**ร้อยละ 10
2) ลดการปล่อยสารที่เป็นมลพิษทางอากาศ ตามประกาศมาตรฐานมลพิษทางอากาศ เช่น NOx HC PM10 SO2 CO O3 VOC's Dioxin หมายเหตุ : มาตรฐานการปล่อยสารที่เป็นมลพิษทางอากาศ สารเจือปนในอากาศ ให้อ้างอิงถึงกฎหมายที่ประกาศโดยหน่วยงานรับผิดชอบ เช่น กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม กรมควบคุมมลพิษ กรมโรงงานอุตสาหกรรม เป็นต้น	ปริมาณการปล่อยสารที่เป็นมลพิษทางอากาศเมื่อเทียบกับกรณีฐาน (กรณีไม่มีโครงการ)	-1 ปริมาณการปล่อยสารที่เป็นมลพิษทางอากาศเพิ่มขึ้น 0 ปริมาณการปล่อยสารมลพิษทางอากาศเท่าเดิม +1 ปริมาณการปล่อยสารมลพิษทางอากาศลดลง	-1 ปริมาณการปล่อยสารมลพิษทางอากาศเพิ่มขึ้น 0 ปริมาณการปล่อยสารมลพิษทางอากาศเท่าเดิม +1 ปริมาณการปล่อยสารมลพิษทางอากาศลดลงน้อยกว่าร้อยละ 20 +2 ปริมาณการปล่อยสารมลพิษทางอากาศลดลงตั้งแต่ร้อยละ 20	-1 ปริมาณการปล่อยสารมลพิษทางอากาศเพิ่มขึ้น 0 ปริมาณการปล่อยสารมลพิษทางอากาศเท่าเดิม +1 ปริมาณการปล่อยสารมลพิษทางอากาศลดลงน้อยกว่าร้อยละ 20 +2 ปริมาณการปล่อยสารมลพิษทางอากาศลดลงตั้งแต่ร้อยละ 20

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
3) มลพิษทางเสียง (ตามมาตรฐานของทางราชการ) หมายเหตุ: มาตรฐานระดับเสียงให้อ้างอิงถึงประกาศคณะกรรมสิ่งแวดล้อมแห่งชาติ ฉบับที่ 15 (พ.ศ.2540) เรื่องกำหนดมาตรฐานระดับเสียงโดยทั่วไป มาตรา 32(5) แห่ง พรบ.ส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. 2535 และประกาศกรมควบคุมมลพิษ เรื่อง การคำนวณค่าระดับเสียง และรวมถึงมาตรฐานอื่นใดที่ประกาศเป็นกฎหมายโดยหน่วยงานรับผิดชอบ	ระดับเสียงต่ำกว่ามาตรฐานเสียง(รบกวนจากแหล่งกำเนิด)/ (ทั่วไป)	0 ระดับเสียงอยู่ที่ค่ามาตรฐาน +1 ระดับเสียงต่ำกว่าค่ามาตรฐาน	-1 ระดับเสียงเกินกว่าค่ามาตรฐาน 0 ระดับเสียงอยู่ที่ค่ามาตรฐาน +1 ระดับเสียงต่ำกว่าค่ามาตรฐานไม่เกิน 10 เดซิเบล +2 ระดับเสียงต่ำกว่าค่ามาตรฐานมากกว่า 10 เดซิเบล	-1 ระดับเสียงเกินกว่าค่ามาตรฐาน 0 ระดับเสียงอยู่ที่ค่ามาตรฐาน +1 ระดับเสียงต่ำกว่าค่ามาตรฐานไม่เกิน 10 เดซิเบล +2 ระดับเสียงต่ำกว่าค่ามาตรฐานมากกว่า 10 เดซิเบล
4) มลพิษทางกลิ่น (ตามมาตรฐานของทางราชการ) หมายเหตุ : การควบคุมมลพิษทางกลิ่น และเหตุเดือดร้อนรำคาญทางกลิ่น ให้อ้างอิงถึงกฎหมายที่ประกาศโดยหน่วยงานรับผิดชอบ เช่น กรมโรงงานอุตสาหกรรม กระทรวงสาธารณสุข กรมควบคุมมลพิษ เป็นต้น	มลพิษทางกลิ่น	0 อยู่ระดับเดียวกับเกณฑ์มาตรฐาน +1 ต่ำกว่ามาตรฐาน	-1 สูงกว่ามาตรฐาน 0 อยู่ระดับเดียวกับเกณฑ์มาตรฐาน +1 ต่ำกว่ามาตรฐาน +2 ปราศจากกลิ่น	-1 สูงกว่ามาตรฐาน 0 อยู่ระดับเดียวกับเกณฑ์มาตรฐาน +1 ต่ำกว่ามาตรฐาน +2 ปราศจากกลิ่น

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
5) ปริมาณความสกปรกในน้ำทิ้งตามมาตรฐานของทางราชการ หมายเหตุ : - มาตรฐานความสกปรกในน้ำทิ้ง ให้เป็นไปตามกฎหมายควบคุมการระบายน้ำทิ้งในความรับผิดชอบของหน่วยงานที่เกี่ยวข้อง เช่น กรมควบคุมมลพิษ กรมโรงงานอุตสาหกรรม กรมเจ้าท่า กรมชลประทาน เป็นต้น - การนำน้ำทิ้งที่บำบัดแล้วไปให้เกษตรกร ไม่ถือเป็น zero discharge แต่ให้ถือเป็นการบริการทางสังคม	ปริมาณความสกปรกในน้ำทิ้ง (loading)	0 ปริมาณความสกปรกในน้ำทิ้งอยู่ในระดับเดียวกับเกณฑ์มาตรฐาน +1 ปริมาณความสกปรกในน้ำทิ้งต่ำกว่ามาตรฐาน +2 ปริมาณความสกปรกในน้ำทิ้งต่ำกว่ามาตรฐาน และปริมาณน้ำทิ้งลดลง +3 ไม่มีการปล่อยน้ำทิ้ง/น้ำเสียออกนอกโครงการ (zero discharge)	0 ปริมาณความสกปรกในน้ำทิ้งอยู่ในระดับเดียวกับเกณฑ์มาตรฐาน +1 ปริมาณความสกปรกในน้ำทิ้งต่ำกว่ามาตรฐาน +2 ปริมาณความสกปรกในน้ำทิ้งต่ำกว่ามาตรฐาน และปริมาณน้ำทิ้งลดลง +3 ไม่มีการปล่อยน้ำทิ้ง/น้ำเสียออกนอกโครงการ (zero discharge)	0 ปริมาณความสกปรกในน้ำทิ้งอยู่ในระดับเดียวกับเกณฑ์มาตรฐาน +1 ปริมาณความสกปรกในน้ำทิ้งต่ำกว่ามาตรฐาน +2 ปริมาณความสกปรกในน้ำทิ้งต่ำกว่ามาตรฐาน และปริมาณน้ำทิ้งลดลง +3 ไม่มีการปล่อยน้ำทิ้ง/น้ำเสียออกนอกโครงการ (zero discharge)
6) การจัดการของเสียของโครงการ หมายเหตุ: ของเสีย หมายถึง สิ่งที่ไม่สามารถนำไปใช้ประโยชน์ได้อีกและเป็นภาระในการจัดการ	ของเสีย (waste) จากโครงการต่อวัตถุดิบป้อนเข้าโครงการ	-1 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าโครงการ เพิ่มขึ้น 0 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าโครงการ เท่าเดิม +1 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าลดลง +2 ไม่มีการปล่อยของเสียออกจากโครงการ	-1 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าโครงการเพิ่มขึ้น 0 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าโครงการ เท่าเดิม +1 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าลดลง +2 ไม่มีการปล่อยของเสียออกจากโครงการ	-1 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าโครงการเพิ่มขึ้น 0 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าโครงการ เท่าเดิม +1 ของเสียออกจากโครงการต่อวัตถุดิบป้อนเข้าลดลง +2 ไม่มีการปล่อยของเสียออกจากโครงการ

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบ เป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่น ขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
7) มลพิษดิน (ตามมาตรฐานทางราชการ) หมายเหตุ: มาตรฐานมลพิษดิน ให้เป็นไปตาม ประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 25 (พ.ศ. 2547) ออกตามความในพรบ. ส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. 2535 เรื่อง กำหนดมาตรฐานคุณภาพดิน และรวมถึงมาตรฐานอื่นใดที่ประกาศเป็น กฎหมายโดยหน่วยงานรับผิดชอบ	มลพิษดิน ตามมาตรฐาน ของทางราชการ	0 ไม่มีมลพิษดิน +1 มีการฟื้นฟูคุณภาพดิน	-1 ก่อให้เกิดมลพิษในดิน 0 ไม่มีมลพิษดิน +1 มีการฟื้นฟูคุณภาพดิน	-1 ก่อให้เกิดมลพิษในดิน 0 ไม่มีมลพิษดิน +1 มีการฟื้นฟูคุณภาพดิน
8) การปนเปื้อนของน้ำใต้ดิน	การปนเปื้อนของน้ำใต้ดิน	n/a ไม่มีการดำเนินงานที่เกี่ยวข้อง	-1 มีการปนเปื้อนน้ำใต้ดิน 0 ไม่มีการปนเปื้อนน้ำใต้ดิน	-1 มีการปนเปื้อนน้ำใต้ดิน 0 ไม่มีการปนเปื้อนน้ำใต้ดิน
9) การลดปริมาณของเสียอันตราย หมายเหตุ : ของเสียอันตราย ให้อ้างอิงถึง กฎหมายที่ประกาศโดยหน่วยงานรับผิดชอบ เช่น กรมควบคุมมลพิษ กรมโรงงาน อุตสาหกรรม	ปริมาณของเสียอันตราย	-1 ปริมาณของเสียอันตราย เพิ่มขึ้น 0 ปริมาณของเสียอันตราย เท่าเดิม +1 ปริมาณของเสียอันตราย ลดลง	-1 ปริมาณของเสียอันตราย เพิ่มขึ้น 0 ปริมาณของเสียอันตราย เท่าเดิม +1 ปริมาณของเสียอันตราย ลดลง	-1 ปริมาณของเสียอันตราย เพิ่มขึ้น 0 ปริมาณของเสียอันตราย เท่าเดิม +1 ปริมาณของเสียอันตราย ลดลง

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
ดัชนีทรัพยากรธรรมชาติ				
10) ความต้องการใช้น้ำและประสิทธิภาพการใช้น้ำของโครงการ	**ปริมาณความต้องการใช้น้ำ** และ **ประสิทธิภาพการใช้น้ำ** ของโครงการ	-2 การใช้น้ำก่อให้เกิดผลกระทบต่อทรัพยากรน้ำและ**สภาพแวดล้อมอื่นๆ** ในลุ่มน้ำ -1 การใช้น้ำก่อให้เกิดผลกระทบต่อทรัพยากรน้ำ **มีการใช้ทรัพยากรน้ำต่อหน่วยผลิตเพิ่มขึ้น** 0 การใช้น้ำไม่ก่อให้เกิดผลกระทบต่อทรัพยากรน้ำและสภาพแวดล้อมอื่นๆ ในลุ่มน้ำ +1 มีแหล่ง**กักเก็บน้ำที่พัฒนาขึ้นเอง** +2 มีแหล่งกักเก็บน้ำที่พัฒนาขึ้นเอง **และปริมาณการใช้น้ำต่อหน่วยลดลง**	-2 การใช้น้ำก่อให้เกิดผลกระทบต่อทรัพยากรน้ำและสภาพแวดล้อมอื่นๆ ในลุ่มน้ำ -1 การใช้น้ำก่อให้เกิดผลกระทบต่อทรัพยากรน้ำ มีการใช้ทรัพยากรน้ำต่อหน่วยผลิตเพิ่มขึ้น 0 การใช้น้ำไม่ก่อให้เกิดผลกระทบต่อทรัพยากรน้ำและสภาพแวดล้อมอื่นๆ ในลุ่มน้ำ +1 มีแหล่งกักเก็บน้ำที่พัฒนาขึ้นเอง +2 มีแหล่งกักเก็บน้ำที่พัฒนาขึ้นเองและปริมาณการใช้น้ำต่อหน่วยลดลง	-2 การใช้น้ำก่อให้เกิดผลกระทบต่อทรัพยากรน้ำและสภาพแวดล้อมอื่นๆ ในลุ่มน้ำ -1 การใช้น้ำก่อให้เกิดผลกระทบต่อทรัพยากรน้ำ มีการใช้ทรัพยากรน้ำต่อหน่วยผลิตเพิ่มขึ้น 0 การใช้น้ำไม่ก่อให้เกิดผลกระทบต่อทรัพยากรน้ำและสภาพแวดล้อมอื่นๆ ในลุ่มน้ำ +1 มีแหล่งกักเก็บน้ำที่พัฒนาขึ้นเอง +2 มีแหล่งกักเก็บน้ำที่พัฒนาขึ้นเองและปริมาณการใช้น้ำต่อหน่วยลดลง
11) การพังทลายของดิน และการกัดเซาะชายฝั่ง/ชายตลิ่งของแม่น้ำ	การพังทลายของดิน และการกัดเซาะชายฝั่ง/ชายตลิ่งของแม่น้ำ ในบริเวณโครงการ	η/a ไม่มีการดำเนินงานที่เกี่ยวข้อง	-1 มีการพังทลายของดินและกัดเซาะชายฝั่ง/ชายตลิ่ง ของแม่น้ำ อันเนื่องมาจากกิจกรรมของโครงการ 0 ไม่มี การพังทลายของดินและกัดเซาะชายฝั่ง/ชายตลิ่งของแม่น้ำ อันเนื่องมาจากกิจกรรมของโครงการ	-1 มีการพังทลายของดินและกัดเซาะชายฝั่ง/ชายตลิ่ง ของแม่น้ำ อันเนื่องมาจากกิจกรรมของโครงการ 0 ไม่มี การพังทลายของดินและกัดเซาะชายฝั่ง/ชายตลิ่งของแม่น้ำ อันเนื่องมาจากกิจกรรมของโครงการ

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
12) การเพิ่มพื้นที่สีเขียวภายใต้โครงการ(ดูสถิติพื้นที่สีเขียวของจังหวัด) หมายเหตุ : เป็นมาตรการส่งเสริมการเพิ่มพื้นที่สีเขียว จึงไม่มีคะแนนติดลบ ซึ่งการเพิ่มพื้นที่สีเขียว อาจเป็นการเพิ่มในบริเวณหรือนอกบริเวณโครงการก็ได้ แต่เป็นการดำเนินงานภายใต้โครงการ ทั้งนี้ ดูความหมายและลักษณะของพื้นที่สีเขียวท้ายตาราง	พื้นที่สีเขียว	0 ไม่มีการเพิ่มพื้นที่สีเขียว +1 มีการเพิ่มพื้นที่สีเขียว +2 มีการเพิ่มพื้นที่สีเขียวสูงกว่าค่าเฉลี่ยของจังหวัด +3 มีการเพิ่มพื้นที่สีเขียวสูงกว่าค่าเฉลี่ยของจังหวัดและไม่มีมลทัศน์	0 ไม่มีการเพิ่มพื้นที่สีเขียว +1 มีการเพิ่มพื้นที่สีเขียว +2 มีการเพิ่มพื้นที่สีเขียวสูงกว่าค่าเฉลี่ยของจังหวัด +3 มีการเพิ่มพื้นที่สีเขียวสูงกว่าค่าเฉลี่ยของจังหวัดและไม่มีมลทัศน์	0 ไม่มีการเพิ่มพื้นที่สีเขียว +1 มีการเพิ่มพื้นที่สีเขียว +2 มีการเพิ่มพื้นที่สีเขียวสูงกว่าค่าเฉลี่ยของจังหวัด +3 มีการเพิ่มพื้นที่สีเขียวสูงกว่าค่าเฉลี่ยของจังหวัดและไม่มีมลทัศน์
13) ความหลากหลายของระบบนิเวศ (ecosystem diversity) เช่น พิจารณาจากการเปลี่ยนพื้นที่นา เป็นพื้นที่ดินถม หรือ การเปลี่ยนจากพื้นที่ดินถม พื้นที่เสื่อมโทรม เป็นพื้นที่ที่มีความหลากหลายทางชีวภาพเพิ่มขึ้น	ผลกระทบต่อความหลากหลายของระบบนิเวศและความหลากหลายทางชีวภาพ	-1 มีผลกระทบต่อระบบนิเวศและความหลากหลายทางชีวภาพ 0 ไม่มีผลกระทบต่อระบบนิเวศและความหลากหลายทางชีวภาพ +1 ระบบนิเวศมีความหลากหลายทางชีวภาพเพิ่มขึ้น	-1 ระบบนิเวศมีความหลากหลายลดลง 0 ไม่มีการเปลี่ยนแปลงระบบนิเวศ +1 ระบบนิเวศมีความหลากหลายเพิ่มขึ้น	-1 ระบบนิเวศมีความหลากหลายลดลง 0 ไม่มีการเปลี่ยนแปลงระบบนิเวศ +1 ระบบนิเวศมีความหลากหลายเพิ่มขึ้น
14) ความหลากหลายของชนิดพันธุ์ (species diversity)	ขนาดของประชากรพืช/สัตว์(population size) และชนิดของพันธุ์พืช/สัตว์	-1 ขนาดของประชากรพืช/สัตว์และชนิดของพันธุ์พืช/สัตว์ลดลง 0 ชนิดของพันธุ์พืช/สัตว์เท่าเดิม +1 ชนิดของพันธุ์พืช/สัตว์ดั้งเดิมเพิ่มขึ้น	-1 ขนาดของประชากรพืช/สัตว์และชนิดของพันธุ์พืช/สัตว์ลดลง 0 ชนิดของพันธุ์พืช/สัตว์เท่าเดิม +1 ชนิดของพันธุ์พืช/สัตว์ดั้งเดิมเพิ่มขึ้น	-1 ขนาดของประชากรพืช/สัตว์และชนิดของพันธุ์พืช/สัตว์ลดลง 0 ชนิดของพันธุ์พืช/สัตว์เท่าเดิม +1 ชนิดของพันธุ์พืช/สัตว์ดั้งเดิมเพิ่มขึ้น

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
15) การใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรม (GMO) และ/หรือชนิดพันธุ์ต่างถิ่น (alien species)ในบริเวณพื้นที่โครงการ	ชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรมและ/หรือชนิดพันธุ์ต่างถิ่น	-1 มีการใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรมและ/หรือชนิดพันธุ์ต่างถิ่น 0 ไม่มีการใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรมและ/หรือชนิดพันธุ์ต่างถิ่น	-1 มีการใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรมและ/หรือชนิดพันธุ์ต่างถิ่น 0 ไม่มีการใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรมและ/หรือชนิดพันธุ์ต่างถิ่น	-1 มีการใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรมและ/หรือชนิดพันธุ์ต่างถิ่น 0 ไม่มีการใช้/ นำเข้าชนิดพันธุ์ที่มีการตัดแต่งพันธุกรรมและ/หรือชนิดพันธุ์ต่างถิ่น
2. หมวดดัชนีด้านสังคม				
1) การมีส่วนร่วมของประชาชน (วัดจากระดับการมีส่วนร่วม ที่จัดขึ้น)	การมีส่วนร่วมของประชาชน	-1 ไม่มีการจัดกระบวนการมีส่วนร่วม 0 จัดกระบวนการมีส่วนร่วมในลักษณะแจ้งให้ทราบ +1 จัดกระบวนการมีส่วนร่วมในลักษณะรับฟังความคิดเห็น +2 จัดกระบวนการมีส่วนร่วมในลักษณะมีตัวแทนชุมชนร่วมเป็นกรรมการ (คณะกรรมการพหุภาคี)	-1 ไม่มีการจัดกระบวนการมีส่วนร่วม 0 จัดกระบวนการมีส่วนร่วมในลักษณะแจ้งให้ทราบ +1 จัดกระบวนการมีส่วนร่วมในลักษณะรับฟังความคิดเห็น +2 จัดกระบวนการมีส่วนร่วมในลักษณะมีตัวแทนชุมชนร่วมเป็นกรรมการ	-1 ไม่มีการจัดกระบวนการมีส่วนร่วม 0 จัดกระบวนการมีส่วนร่วมในลักษณะแจ้งให้ทราบ +1 จัดกระบวนการมีส่วนร่วมในลักษณะรับฟังความคิดเห็น +2 จัดกระบวนการมีส่วนร่วมในลักษณะมีตัวแทนชุมชนร่วมเป็นกรรมการ

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบ เป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่น ขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
2) สนับสนุนกิจกรรมพัฒนาสังคม วัฒนธรรม และแนวทางปรัชญาเศรษฐกิจพอเพียง หมายเหตุ : เป็นมาตรการส่งเสริมให้โครงการสนับสนุนการพัฒนาสังคม วัฒนธรรม สุขภาพอนามัย สาธารณูปโภค สาธารณูปการ แนวทางปรัชญาเศรษฐกิจพอเพียง และการพัฒนาสิ่งแวดล้อมของชุมชน จึงไม่มีคะแนนติดลบ ซึ่งการสนับสนุนกิจกรรมชุมชนสัมพันธ์ดังกล่าว อาจเป็นการดำเนินงานในบริเวณหรือนอกบริเวณโครงการก็ได้ แต่เป็นการดำเนินงานภายใต้โครงการ	สนับสนุนกิจกรรมพัฒนาสังคม วัฒนธรรม และแนวทางปรัชญาเศรษฐกิจพอเพียง เช่น ▪ โครงการหรือกิจกรรมที่ส่งเสริมแนวทางปรัชญาเศรษฐกิจพอเพียง ▪ การคุ้มครองมรดกทางธรรมชาติและศิลปกรรม ▪ การให้ทุนการศึกษา ▪ กิจกรรมทางศาสนาและศิลปวัฒนธรรม ▪ ส่งเสริมด้านสุขภาพอนามัย ▪ พัฒนาศูนย์เด็กเล็ก ▪ จัดหาน้ำดื่ม ▪ ฯลฯ	0 ไม่มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะ +1 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนร้อยละ 1 ถึง 5 เมื่อเทียบกับรายได้สุทธิของโครงการ +2 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนมากกว่าร้อยละ 5 ของรายได้สุทธิของโครงการ +3 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนมากกว่าร้อยละ 5 ของรายได้สุทธิของโครงการและมีการจัดตั้งกองทุนซึ่งมีทุนประเดิมไม่ต่ำกว่า 5 ล้านบาทและมีเงินทุนสมทบรายปีไม่ต่ำกว่า 5 แสนบาท	0 ไม่มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะ +1 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนร้อยละ 1 ถึง 5 เมื่อเทียบกับรายได้สุทธิของโครงการ +2 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนมากกว่าร้อยละ 5 ของรายได้สุทธิของโครงการ +3 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนมากกว่าร้อยละ 5 ของรายได้สุทธิของโครงการและมีการจัดตั้งกองทุนซึ่งมีทุนประเดิมไม่ต่ำกว่า 5 ล้านบาทและมีเงินทุนสมทบรายปีไม่ต่ำกว่า 5 แสนบาท	0 ไม่มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะ +1 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนร้อยละ 1 ถึง 5 เมื่อเทียบกับรายได้สุทธิของโครงการ +2 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนมากกว่าร้อยละ 5 ของรายได้สุทธิของโครงการ +3 มีการให้บริการพัฒนาสังคมและกิจกรรมสาธารณะในอัตราส่วนมากกว่าร้อยละ 5 ของรายได้สุทธิของโครงการและมีการจัดตั้งกองทุนซึ่งมีทุนประเดิมไม่ต่ำกว่า 5 ล้านบาทและมีเงินทุนสมทบรายปีไม่ต่ำกว่า 5 แสนบาท
3) สุขภาพอนามัยของคนงานและชุมชนโดยรอบ	แผนการจัดการสุขภาพอนามัยของคนงานและชุมชนโดยรอบ	0 ปฏิบัติตาม พรบ. แรงงานสัมพันธ์ +1 มีแผนดูแล ป้องกันและบรรเทาอุบัติภัยจากการทำงาน +2 มีแผนส่งเสริมสนับสนุนสุขภาพให้กับคนงานและชุมชนโดยรอบ	0 ปฏิบัติตาม พรบ. แรงงานสัมพันธ์ +1 มีแผนดูแล ป้องกันและบรรเทาอุบัติภัยจากการทำงาน +2 มีแผนส่งเสริมสนับสนุนสุขภาพให้กับคนงานและชุมชนโดยรอบ	0 ปฏิบัติตาม พรบ. แรงงานสัมพันธ์ +1 มีแผนดูแล ป้องกันและบรรเทาอุบัติภัยจากการทำงาน +2 มีแผนส่งเสริมสนับสนุนสุขภาพให้กับคนงานและชุมชนโดยรอบ

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
3. หมวดดัชนีด้านการพัฒนาและ/หรือการถ่ายทอดเทคโนโลยี				
1) การพัฒนาเทคโนโลยี	การพัฒนา/นำเข้าเทคโนโลยี	-1 ใช้เทคโนโลยีที่ไม่เหมาะสม ไม่ปรับให้เหมาะต่อความ ต้องการของท้องถิ่นผู้ประกอบการท้องถิ่น ไม่มีส่วนร่วมในการติดตั้ง หรือบำรุงรักษาไม่มีการจ้างผู้ประกอบการท้องถิ่นในการผลิตอุปกรณ์	-1 ใช้เทคโนโลยีที่ไม่เหมาะสม ไม่ปรับให้เหมาะต่อความ ต้องการของท้องถิ่นผู้ประกอบการท้องถิ่น ไม่มีส่วนร่วมในการติดตั้ง หรือบำรุงรักษาไม่มีการจ้างผู้ประกอบการท้องถิ่นในการผลิตอุปกรณ์	-1 ใช้เทคโนโลยีที่ไม่เหมาะสม ไม่ปรับให้เหมาะต่อความ ต้องการของท้องถิ่นผู้ประกอบการท้องถิ่น ไม่มีส่วนร่วมในการติดตั้ง หรือบำรุงรักษาไม่มีการจ้างผู้ประกอบการท้องถิ่นในการผลิตอุปกรณ์
		0 ใช้เทคโนโลยีมาตรฐานในประเทศ	0 ใช้เทคโนโลยีมาตรฐานในประเทศ	0 ใช้เทคโนโลยีมาตรฐานในประเทศ
		+1 เป็นเทคโนโลยีที่เหมาะสมที่สุดที่จัดหาได้ในประเทศพัฒนาแล้ว และเป็นเทคโนโลยีที่ง่ายต่อการใช้และบำรุงรักษาโดยท้องถิ่น รวมทั้งเหมาะสมต่อสภาพสิ่งแวดล้อมสังคมและ เศรษฐกิจของท้องถิ่น	+1 เป็นเทคโนโลยีที่เหมาะสมที่สุดที่จัดหาได้ในประเทศพัฒนาแล้ว และเป็นเทคโนโลยีที่ง่ายต่อการใช้และบำรุงรักษาโดยท้องถิ่น รวมทั้งเหมาะสมต่อสภาพสิ่งแวดล้อมสังคมและ เศรษฐกิจของท้องถิ่น	+1 เป็นเทคโนโลยีที่เหมาะสมที่สุดที่จัดหาได้ในประเทศพัฒนาแล้ว และเป็นเทคโนโลยีที่ง่ายต่อการใช้และบำรุงรักษาโดยท้องถิ่น รวมทั้งเหมาะสมต่อสภาพสิ่งแวดล้อมสังคมและ เศรษฐกิจของท้องถิ่น
		+2 เป็นเทคโนโลยีที่พัฒนาขึ้นในประเทศง่ายต่อการใช้และบำรุงรักษาโดยท้องถิ่น รวมทั้งเหมาะสมต่อสภาพ เศรษฐกิจและสังคมของท้องถิ่น	+2 เป็นเทคโนโลยีที่พัฒนาขึ้นในประเทศง่ายต่อการใช้และบำรุงรักษาโดยท้องถิ่น รวมทั้งเหมาะสมต่อสภาพ เศรษฐกิจและสังคมของท้องถิ่น	+2 เป็นเทคโนโลยีที่พัฒนาขึ้นในประเทศง่ายต่อการใช้และบำรุงรักษาโดยท้องถิ่น รวมทั้งเหมาะสมต่อสภาพ เศรษฐกิจและสังคมของท้องถิ่น

I. ตัวชี้วัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
2) แผนการดำเนินงานเมื่อสิ้นสุดโครงการ หรือสิ้นสุดระยะเวลา Crediting Period ที่โครงการเลือกไว้	แผนการดำเนินงานเมื่อสิ้นสุดโครงการ หรือสิ้นสุดระยะเวลา Crediting Period ที่โครงการเลือกไว้	0 **ไม่มีแผน**การดำเนินงานเมื่อสิ้นสุดโครงการหรือระยะเวลา Crediting Period ที่โครงการเลือกไว้ +1 **มีแผน**การดำเนินงานเมื่อสิ้นสุดโครงการหรือระยะเวลา Crediting Period ที่โครงการเลือกไว้	0 ไม่มีแผนการดำเนินงานเมื่อสิ้นสุดโครงการหรือระยะเวลา Crediting Period ที่โครงการเลือกไว้ +1 มีแผนการดำเนินงานเมื่อสิ้นสุดโครงการหรือระยะเวลา Crediting Period ที่โครงการเลือกไว้ร	0 ไม่มีแผนการดำเนินงานเมื่อสิ้นสุดโครงการหรือระยะเวลา Crediting Period ที่โครงการเลือกไว้ +1 มีแผนการดำเนินงานเมื่อสิ้นสุดโครงการหรือระยะเวลา Crediting Period ที่โครงการเลือกไว้
3) การฝึกอบรมบุคลากร	จำนวนลูกจ้างที่มีทักษะการทำงานดี	-1 จำนวนลูกจ้างที่มีทักษะการทำงานดี ลดลง 0 จำนวนลูกจ้างที่มีทักษะการทำงานดี เท่าเดิม +1 จำนวนลูกจ้างที่มีทักษะการทำงานดี เพิ่มขึ้น	-1 จำนวนลูกจ้างที่มีทักษะการทำงานดี ลดลง 0 จำนวนลูกจ้างที่มีทักษะการทำงานดี เท่าเดิม +1 จำนวนลูกจ้างที่มีทักษะการทำงานดี เพิ่มขึ้น	-1 จำนวนลูกจ้างที่มีทักษะการทำงานดี ลดลง 0 จำนวนลูกจ้างที่มีทักษะการทำงานดี เท่าเดิม +1 จำนวนลูกจ้างที่มีทักษะการทำงานดี เพิ่มขึ้น

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
4. หมวดดัชนีด้านเศรษฐกิจ				
1) รายได้ที่เพิ่มขึ้นของผู้มีส่วนได้ส่วนเสีย	ค่าเฉลี่ยจากผลรวมของคะแนนใน 1.1-1.2	ค่าเฉลี่ยจากผลรวมของคะแนนใน 1.1-1.2	ค่าเฉลี่ยจากผลรวมของคะแนนใน 1.1-1.2	ค่าเฉลี่ยจากผลรวมของคะแนนใน 1.1-1.2
(1.1) รายได้ที่เพิ่มขึ้นของคนงาน หมายเหตุ : รายได้ของคนงาน หมายถึง ค่าจ้าง ค่าแรง ค่าล่วงเวลา ซึ่งเป็นค่าตอบแทนที่เป็นตัวเงิน	รายได้ของคนงานต่อปี	0 รายได้ของคนงาน เท่าเดิม +1 รายได้ของคนงาน เพิ่มขึ้น	0 รายได้ของคนงาน เท่าเดิม +1 รายได้ของคนงาน เพิ่มขึ้น	0 รายได้ของคนงาน เท่าเดิม +1 รายได้ของคนงาน เพิ่มขึ้น **น้อยกว่า**ร้อยละ 10 +2 รายได้ของคนงาน เพิ่มขึ้น**เท่ากับ หรือ มากกว่า**ร้อยละ 10
(1.2) รายได้ที่เพิ่มขึ้นของผู้มีส่วนได้ส่วนเสียอื่น เช่น เกษตรกรมีรายได้เพิ่มขึ้นจากการขายวัตถุดิบ หมายเหตุ ผู้พัฒนาโครงการจะต้องระบุว่าใครคือผู้มีส่วนได้ ส่วนเสีย ในการขายวัตถุดิบให้กับโครงการ	รายได้ของผู้มีส่วนได้ส่วนเสีย	-1 รายได้ของผู้มีส่วนได้ส่วนเสียลดลง 0 รายได้ของผู้มีส่วนได้ส่วนเสีย เท่าเดิม +1 รายได้ของผู้มีส่วนได้ส่วนเสียเพิ่มขึ้น	-1 รายได้ของผู้มีส่วนได้ส่วนเสียลดลง 0 รายได้ของผู้มีส่วนได้ส่วนเสีย เท่าเดิม +1 รายได้ของผู้มีส่วนได้ส่วนเสีย เพิ่มขึ้น	-1 รายได้ของผู้มีส่วนได้ส่วนเสียลดลง 0 รายได้ของผู้มีส่วนได้ส่วนเสีย เท่าเดิม +1 รายได้ของผู้มีส่วนได้ส่วนเสีย เพิ่มขึ้นน้อยกว่าร้อยละ 10 +2 รายได้ของผู้มีส่วนได้ส่วนเสีย เพิ่มขึ้นเท่ากับหรือมากกว่าร้อยละ10

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบ เป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่น ขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
2) พลังงาน	การใช้พลังงานทดแทน หรือ ประสิทธิภาพการใช้ พลังงาน (ร้อยละ)	ค่าเฉลี่ยของ 2.1 และ 2.2	ค่าเฉลี่ยของ 2.1 และ 2.2	ค่าเฉลี่ยของ 2.1 และ 2.2
(2.1) **การใช้พลังงานทดแทน**	การใช้พลังงานทดแทน น้ำมันเชื้อเพลิง/พลังงาน หมุนเวียนในประเทศ (ton of oil equivalent)	0 ปริมาณการใช้พลังงานทดแทน เท่าเดิม +1 ปริมาณการใช้พลังงานทดแทน เพิ่มขึ้น	0 การใช้พลังงานทดแทน เท่าเดิม +1 เพิ่มการใช้พลังงานทดแทน**น้อย กว่า**ร้อยละ 50 +2 เพิ่มการใช้พลังงานทดแทน **เท่ากับหรือมากกว่า**ร้อยละ 50	0 การใช้พลังงานทดแทน เท่าเดิม +1 เพิ่มการใช้พลังงานทดแทน**น้อย กว่า**ร้อยละ 50 +2 เพิ่มการใช้พลังงานทดแทน **เท่ากับหรือมากกว่า**ร้อยละ 50
(2.2) **ประสิทธิภาพการใช้ พลังงาน**	ร้อยละของประสิทธิภาพ การใช้พลังงาน	0 ประสิทธิภาพการใช้พลังงานเท่าเดิม +1 ประสิทธิภาพการใช้พลังงาน เพิ่มขึ้น	0 ประสิทธิภาพการใช้พลังงานเท่าเดิม +1 ประสิทธิภาพการใช้พลังงาน **เพิ่มขึ้นน้อยกว่า**ร้อยละ 5 +2 ประสิทธิภาพการใช้พลังงาน **เพิ่มขึ้นตั้งแต่ร้อยละ 5 ขึ้นไป**	0 ประสิทธิภาพการใช้พลังงานเท่าเดิม +1 ประสิทธิภาพการใช้พลังงาน **เพิ่มขึ้นน้อยกว่า**ร้อยละ 5 +2 ประสิทธิภาพการใช้พลังงาน **เพิ่มขึ้นตั้งแต่ร้อยละ 5 ขึ้นไป**

I. ดัชนีวัด	II. เกณฑ์การให้คะแนน	ระดับการให้คะแนน		
		III. โครงการใหม่ที่ยื่นขอความเห็นชอบเป็นโครงการ CDM (PDD)	IV. โครงการที่ได้เริ่มดำเนินการแล้วและยื่นขอความเห็นชอบเป็นโครงการ CDM	V. ติดตามประเมินผลการดำเนินโครงการ CDM ที่ได้รับความเห็นชอบแล้ว
3) การเพิ่มการใช้วัตถุดิบภายในประเทศ	สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ	-1 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ ลดลง 0 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ เท่าเดิม +1 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ **เพิ่มขึ้นน้อยกว่าร้อยละ 50** +2 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ **เพิ่มขึ้น เท่ากับหรือมากกว่าร้อยละ 50** +3 มีระบบการจัดการราคาและวัตถุดิบที่เป็นธรรมต่อผู้มีส่วนเกี่ยวข้องทุกฝ่าย	-1 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ ลดลง 0 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ เท่าเดิม +1 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ **เพิ่มขึ้นน้อยกว่าร้อยละ 50** +2 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ **เพิ่มขึ้น เท่ากับหรือมากกว่าร้อยละ 50** +3 มีระบบการจัดการราคาและวัตถุดิบที่เป็นธรรมต่อผู้มีส่วนเกี่ยวข้องทุกฝ่าย	-1 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ ลดลง 0 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ เท่าเดิม +1 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ **เพิ่มขึ้นน้อยกว่าร้อยละ 50** +2 สัดส่วนมูลค่าการใช้วัตถุดิบภายในประเทศ **เพิ่มขึ้น เท่ากับหรือมากกว่าร้อยละ 50** +3 มีระบบการจัดการราคาและวัตถุดิบที่เป็นธรรมต่อผู้มีส่วนเกี่ยวข้องทุกฝ่าย

หมายเหตุ : **พื้นที่สีเขียว** หมายถึง พื้นที่โล่งซึ่งมีพืชพรรณเป็นองค์ประกอบหลัก ได้รับการจัดการตามหลักวิชาวนวัฒนวิทยาและภูมิสถาปัตย์ เพื่อเสริมสร้างภูมิทัศน์ให้เอื้ออำนวยต่อการพักผ่อนหย่อนใจ และทำหน้าที่เป็นปอดของเมืองอย่างยั่งยืน อันจะทำให้ชุมชนเมืองเป็นเมืองสีเขียวที่น่าอยู่ตลอดไป จะเป็นที่ดินของรัฐ ที่ดินเอกชน หรือที่ดินประเภทพิเศษ ซึ่งได้แก่ ที่ดินทรัพย์สินส่วนพระมหากษัตริย์ และที่ดินศาสนสถานก็ได้ จุดสำคัญไม่ได้อยู่ที่ความเป็นเจ้าของ แต่อยู่ที่หน้าที่หลักของที่ดินนั้นๆ ขอบเขตของพื้นที่ที่จัดว่าเป็นพื้นที่สีเขียวในเขตชุมชนได้แก่

1) พื้นที่ธรรมชาติ หมายถึง พื้นที่แหล่งน้ำ ลำธาร คูคลอง ทะเลสาบ พรุ บึง ชายหาด เนินเขา ภูเขา และป่าไม้ ซึ่งจำเป็นจะต้องอนุรักษ์ไว้
2) พื้นที่สีเขียวเพื่อบริการ ได้แก่ สวนสาธารณะ สนามกีฬากลางแจ้ง สนามเด็กเล่น ลานเมือง สวนพฤกษศาสตร์ สวนรุกขชาติ สวนสุขภาพ สวนสัตว์ ฯลฯ ซึ่งประชาชนสามารถเข้าไปใช้บริการได้
3) พื้นที่สีเขียวเพื่อสิ่งแวดล้อม ได้แก่ พื้นที่สวนไม้ผลยืนต้น สวนป่า พื้นที่สีเขียวในหน่วยงานราชการ และในที่ดินของเอกชน แม้ประชาชนจะไม่สามารถเข้าไปใช้บริการได้โดยตรงแต่มีคุณค่าด้านสิ่งแวดล้อมต่อชุมชนโดยรวม ซึ่งเป็นเสมือนหนึ่งปอดของชุมชนเมือง
4) พื้นที่สีเขียวริมเส้นทางสัญจร ได้แก่ พื้นที่แนวถนน เกาะกลางถนน ทางเดิน แนวถอยร่น ริมแม่น้ำ และริมทางรถไฟ

> **CLEAN DEVELOPMENT MECHANISM**
> **PROJECT DESIGN DOCUMENT FORM FOR AFFORESTATION AND REFORESTATION**
> **PROJECT ACTIVITIES (CDM-AR-PDD)**

CONTENTS

Annexes

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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

SECTION A. General description of the proposed A/R CDM project activity:

A.1. Title of the proposed A/R CDM project activity:

Title: Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin
Version: GIFDCP02
Date of the document: July 21, 2006

A.2. Description of the proposed A/R CDM project activity:

The proposed A/R CDM project activity, Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin, China, aims to explore and demonstrate the technical and methodological approaches related to credible carbon sequestration and pilot the viability of enhancing the livelihoods of people and natural environment by facilitating reforestation activities in watershed areas along the Pearl River Basin. The proposed A/R CDM project will generate the income to the poor farmers/communities by enabling the carbon sequestered by plantations to act like a "virtual cash crop" for the local project beneficiaries who will gain direct benefits from harvesting the plantation as well as from the sale of carbon credits, which will in turn reduce the threats to natural forests. In addition, forest restoration in this area plays a vital role in biodiversity conservation, soil and water conservation and poverty alleviation, while sequestering carbon dioxide from the atmosphere. The specific project objectives include:

(1) To sequester CO_2 through forest restoration in small watershed areas and test and pilot how reforestation activities generate high-quality emission reductions in greenhouse gases that can be measured, monitored and verified;

(2) To enhance biodiversity conservation by increasing the connectivity of forests adjacent to nature reserves;

(3) To improve soil and water erosion control;

(4) To generate income for local communities.

To achieve the objectives, the following A/R CDM project activity is proposed:

(1) Establishing 2,000 ha of multiple-use forests in Huanjiang County of Guangxi (including approximately 830 ha on sites neighboring Mulun National Nature Reserve and Shiwanshan National Nature Reserve, and around 1,170 ha on sites between them). Species and afforestation models include *Pinus massoniana* mixed with *Liquidambar formosana* (1,050 ha), *Cunninghamia lanceolata* mixed with *L. formosana* (450 ha), and *Eucalyptus* sp. (*E.grandis*×*E.urophylla*) (500 ha);

(2) Establishing 2,000 ha of multiple-use forests on sites with severe soil and water erosion in Cangwu County of Guangxi. Major species and afforestation models include *P. massoniana* mixed with *Quercus griffithii* (600 ha), *P. massoniana* mixed with *Schima. superba* (900 ha), and *Eucalyptus* sp. (500 ha).

In order to ensure unified management measures, homogeneous growth of the plantations, effective monitoring work, as well as maintain the carbon sequestered and reduce risks from natural disasters during the crediting period, the proposed A/R CDM project activity will be largely implemented through cooperation arrangements between farmers/communities and farms/companies. The project activity arrangements are decided through a participatory process carried out at the village level, reflecting the preference of the farmers and communities through consultation with them. Although interviews with

farmers and communities by the local project agencies and the expert team confirmed the desirability of the above arrangement, some households would also like to invest and manage the reforestation activities through a farmers group. The local forestry agencies have committed to provide training and other technical services to the farmers/communities on the plantation establishment and management to ensure the plantation quality and to reduce management risks.

production arrangements and management models are sumerized as the following:

> Shareholding arrangements between local farmers/communities and forest company. Local farmers/communities will contribute lands and labors. Local forest company will invest in planting activities, provide technical inputs and manage the plantations during the crediting period, as well as take the natural and investment risks. The contractual arrangements will be made between the farmers/communities and the company on the plantation establishment and management responsibilities, inputs and benefit sharing. About 3,560 ha of sites will be managed under this model. The farmers/communities and forest company will share net income from forest products based on their inputs and farmers/communities will share more portion of revenues from CER transactions. In addition, the forest farms/companies will pay farmers' labor inputs to ensure their short-term income.

> Farmers group. Individual farmers voluntarily group-invest and undertake project activities, including site and soil preparation, planting and stand management. The lands are owned by the local villages (communities), but are contracted with farmers for plantation establishment and management for 50 years. The local forestry agencies will provide assistance for the planting design and other technical services including training, as well as supervising the project implementation and planting quality. Income from forest products and CER transactions would belong solely to the local farmers. About 440 ha of site will be managed under this model. The farmer groups have authorized the company to conduct project application, registration of the proposed A/R CDM project activity, and CER selling on behalf of them.

The proposed A/R CDM project activity will be implemented separately, but linked with a larger umbrella Guangxi Integrated Forestry Development and Conservation Project (GIFDCP) in order to effectively monitor the project implementation and impacts, particularly the environmental and social impacts. The umbrella project would addresses the closely inter-linked threats to the natural forests, watersheds and biodiversity in Guangxi Zhuang Autonomous Region through an integrated approach to managing all these natural resources at the landscape level. Its development and global environment outcomes will improve the supply, management, sustainability, and environmental conditions of the forest resources in Guangxi and conserve its globally significant biodiversity. This umbrella project would include four components: (i) expanding timber plantations to reduce the pressure on nature forests; (ii) increasing ecological forest cover in watershed areas; (iii) strengthening the management of nature reserves and (iv) enhancing institutional and management capacity for forestry sector.

A.3. **Project participants:**

Table A-1 Project participants

PROJECT DESIGN DOCUMENT FORM
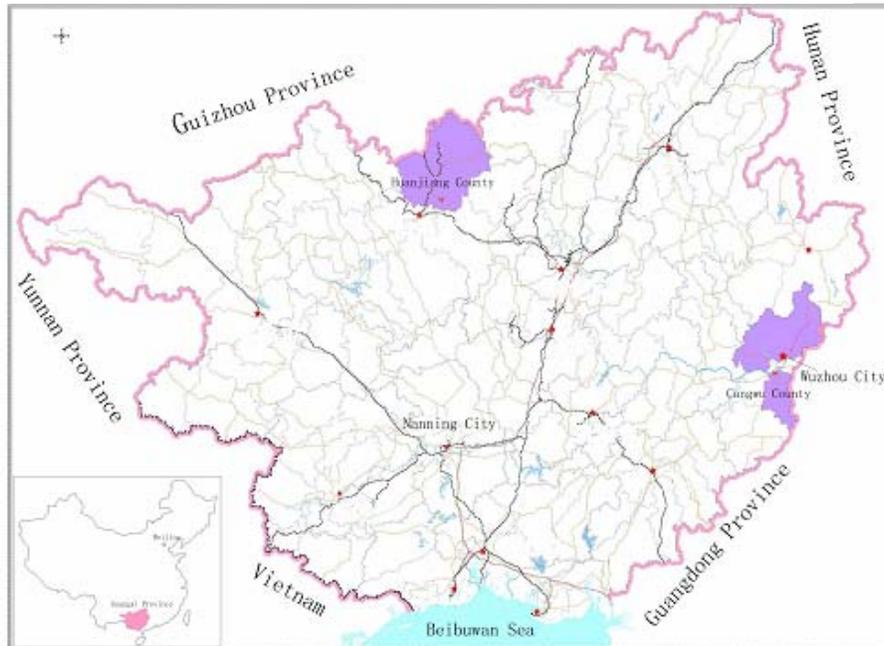**FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02**

Name of Party involved (*) ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*)** (as applicable)	**Kindly indicate if the Party involved wishes to be considered as project participant** (Yes/No)
People's Republic of China	Private entity : Xinghuan Forestry Development Company Ltd, Huanjiang County, P.R. China	No
Italy	The International Bank for Reconstruction and Development (IBRD) as Trustee of the BioCarbon Fund	Yes
Spain	The International Bank for Reconstruction and Development (IBRD) as Trustee of the BioCarbon Fund	Yes

A.4. Technical description of the A/R CDM project activity:

A.4.1. Location of the proposed A/R CDM project activity:

The proposed A/R CDM project activity is located in Cangwu County (in the Eastern part of map) and Huanjiang County (in the Northern part of map), Guangxi Zhuang Autonomous Region, in southern China (Fig.A-1).

Fig.A-1 Locations of the proposed A/R CDM project activity

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

A.4.1.1.	**Host Party(ies):**

P.R. China

A.4.1.2.	**Region/State/Province etc.:**

Guangxi Zhuang Autonomous Region

A.4.1.3.	**City/Town/Community etc:**

Lands to be reforested are located in 13 villages of 4 towns/townships in Cangwu County and 14 villages of 6 towns/townships in Huanjiang County.

Table A-2 List of Counties, towns/townships and villages involved

Cangwu County		Latitude (N, degree)	Longitude (E, degree)
Towns/Townships	Villages		
Dapo	Shengzhou	111.30214-111.38319	23.18890-23.24468
	Xinlong	111.26641-111.31870	23.18389-23.23788
	Dayan	111.32941-111.39390	23.14746-23.18596
Xindi	Diancun	111.14224-111.18855	23.26278-23.31513
	Dongxin	111.14349-111.18876	23.30142-23.32902
	Xunchun	111.13368-111.20041	23.15172-23.18319
	Dacun	11.189990-111.21657	23.33486-23.35340
	Daton	111.16250-111.20237	23.30050-23.35690
Longxu	Enyi	111.24467-111.27654	23.38740-23.44081
	Daen	111.18076-111.24528	23.34605-23.39321
Shatou	Cantian	111.48480-111.58910	24.04140-24.15430
	Shichuan	111.48530-111.53740	24.09310-24.17200
	Shentang	111.38871-111.47016	23.93381-24.04026
Huanjiang County			
Xunle	Taiping	108.30170-108.36460	25.24880-25.34270
	Shangang	108.28420-108.41080	25.44830-25.54000
Chuanshan	Hedun	108.07210-108.18020	25.11300-25.20940
Mulun	Leyi	107.96206-108.02698	25.07901-25.13427
Minglun	Minglun	108.32830-108.47680	25.15100-25.23620
	Baixiang	108.38310-108.44510	25.13800-25.19440
	Cuishan	108.34180-108.45050	25.26620-25.34140
Longyan	Huangzhong	108.36910-108.46960	25.37330-25.45990
	Jiuwei	108.35310-108.43720	25.31870-25.37580
	Dake	108.50030-108.61030	25.27220-25.33440
	chaoge	108.49880-108.59050	25.31400-25.41600
	Longyan	108.44375-108.51672	25.25342-25.30658
	Chenghuang	108.34800-108.42300	25.35410-25.42670
Shangchao	Beishan	108.12510-108.23410	25.18670-25.30860

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

> **A.4.1.4.** **Detail of geographical location and project boundary, including information allowing the unique identification(s) of the proposed A/R CDM project activity:**

The project boundaries and geographical locations are indicated in figures below and the specific geographical positions (longitude, latitude) at each corner of each of 80 patches of sites have been determined using GPS (see attached spreadsheet).

Fig. A-2 Lands to be planted in Longxu, Xindi and Dapo Towns in Cangwu County
1:250,000
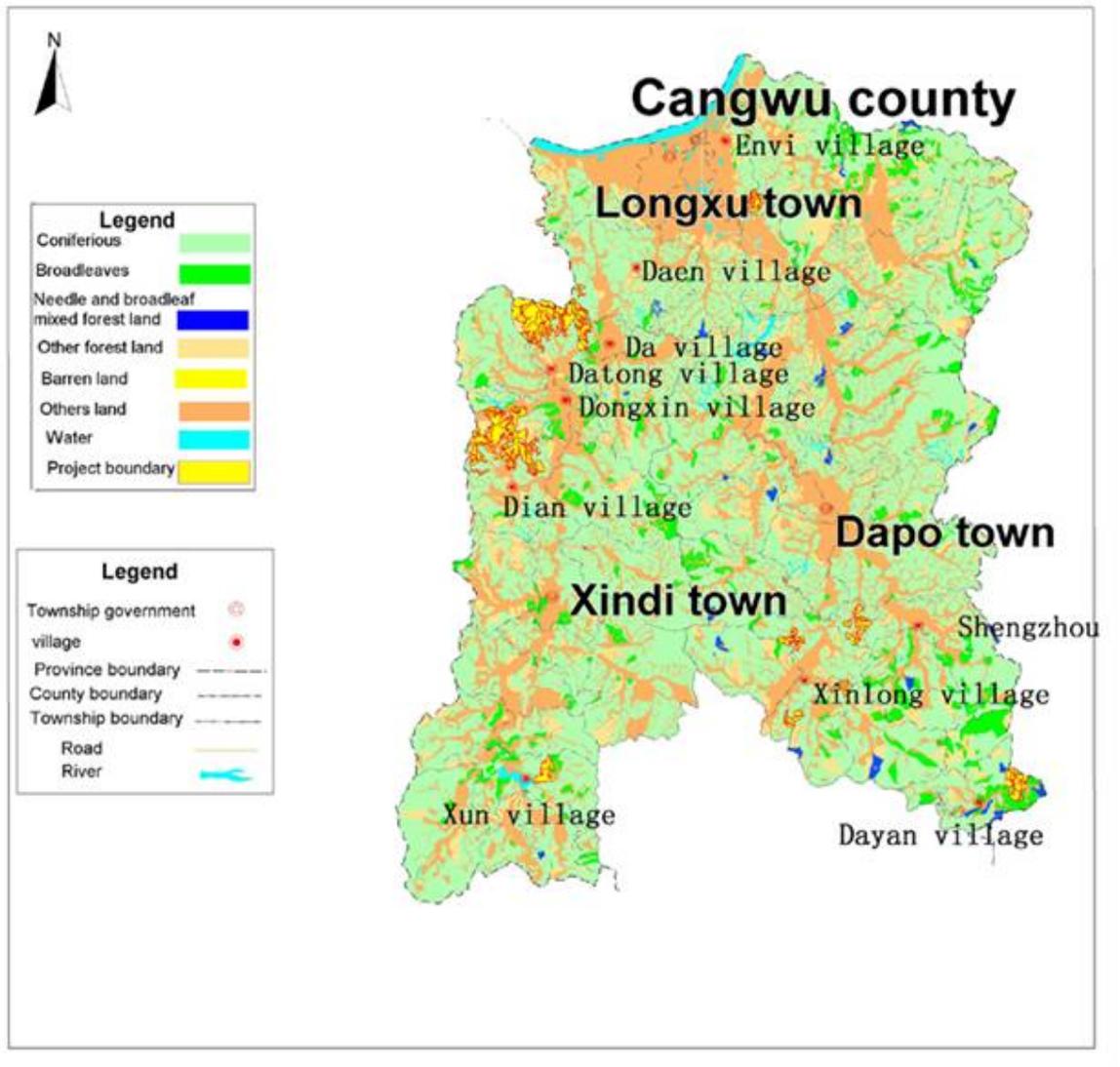
PROJECT DESIGN DOCUMENT FORM
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Fig. A-3 Lands to be planted in Satou Town in Cangwu County (1:250,000)
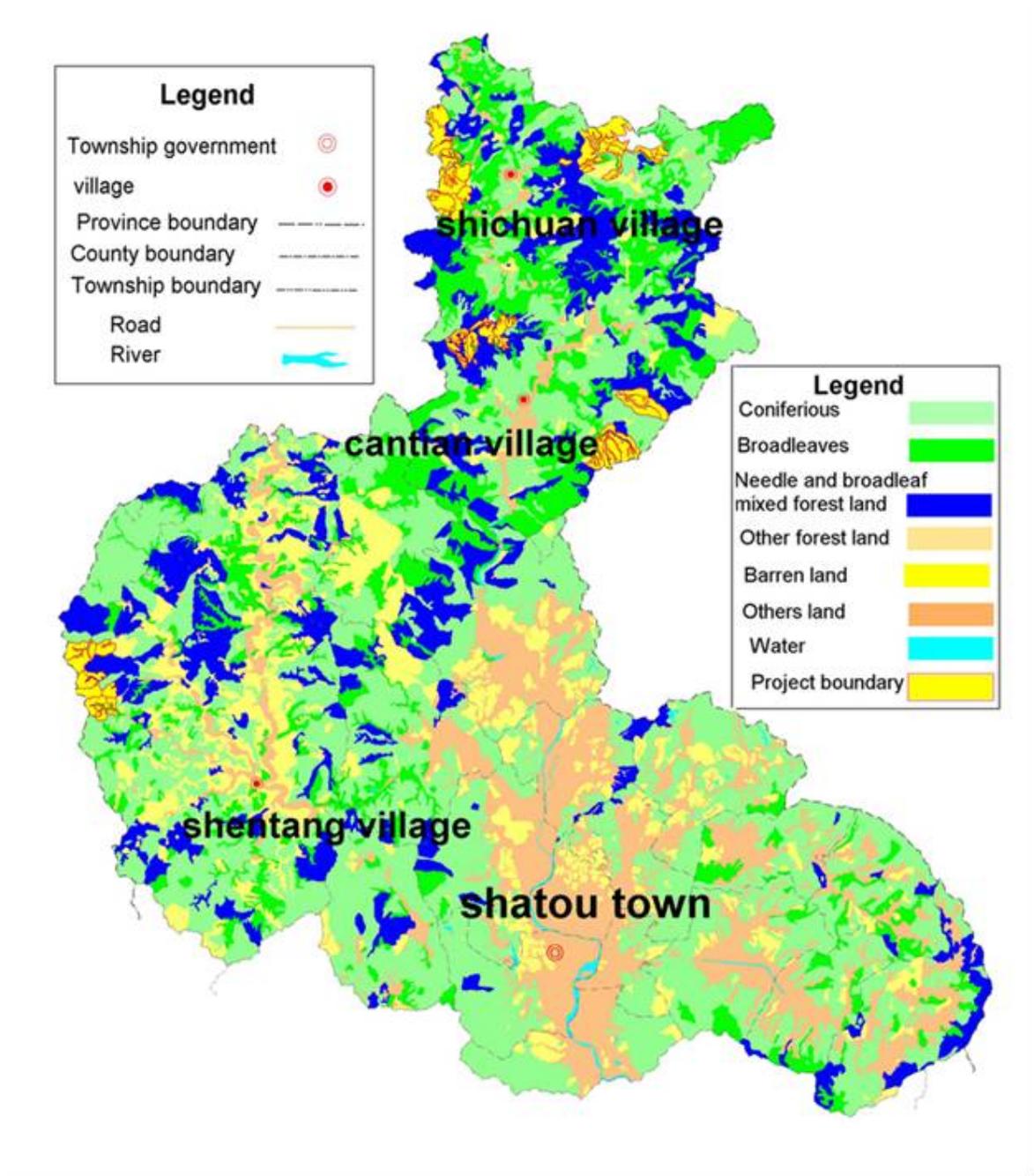
PROJECT DESIGN DOCUMENT FORM
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Fig. A-4   Lands to be planted in Longyan, Minglun and Xunle
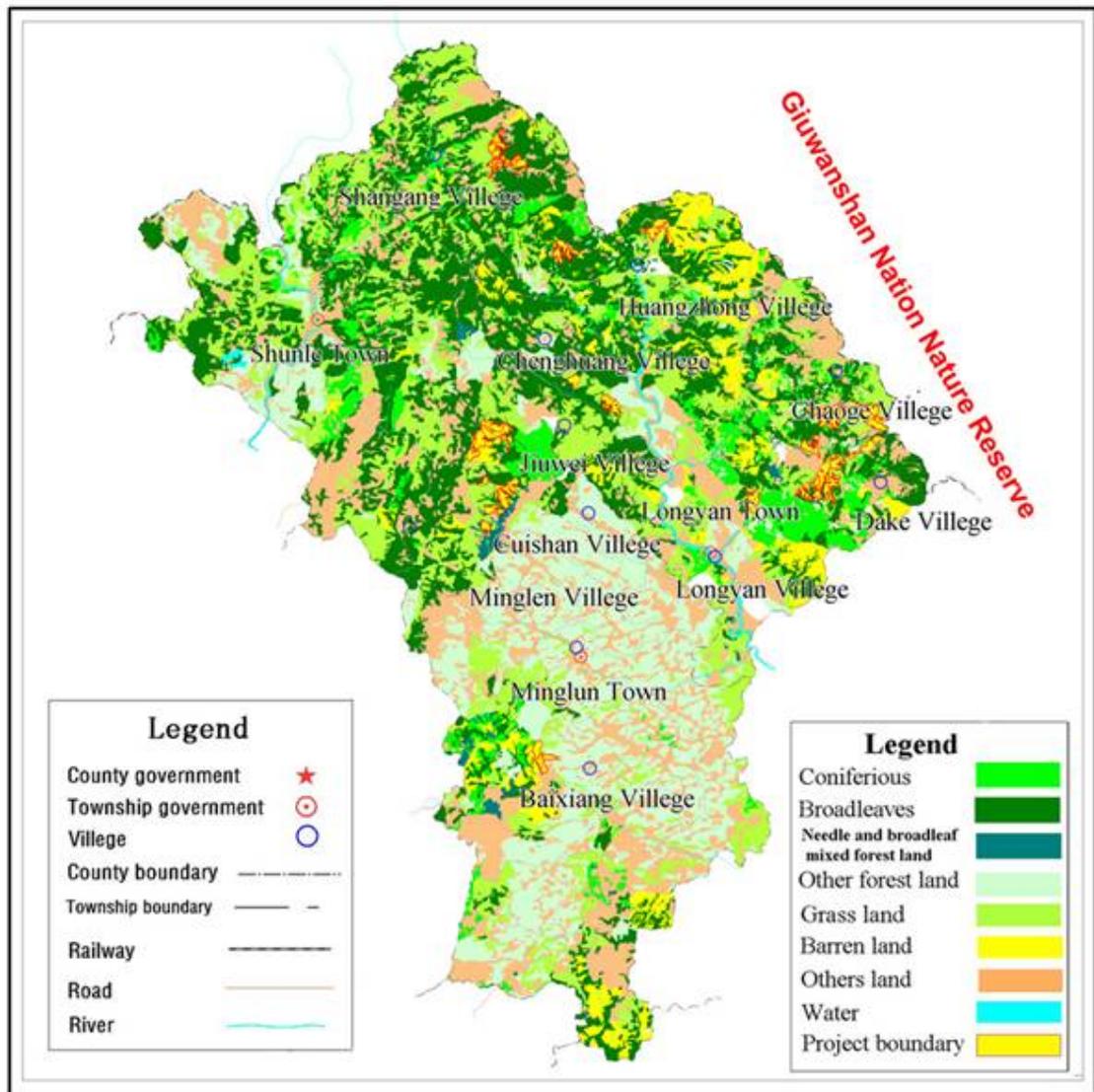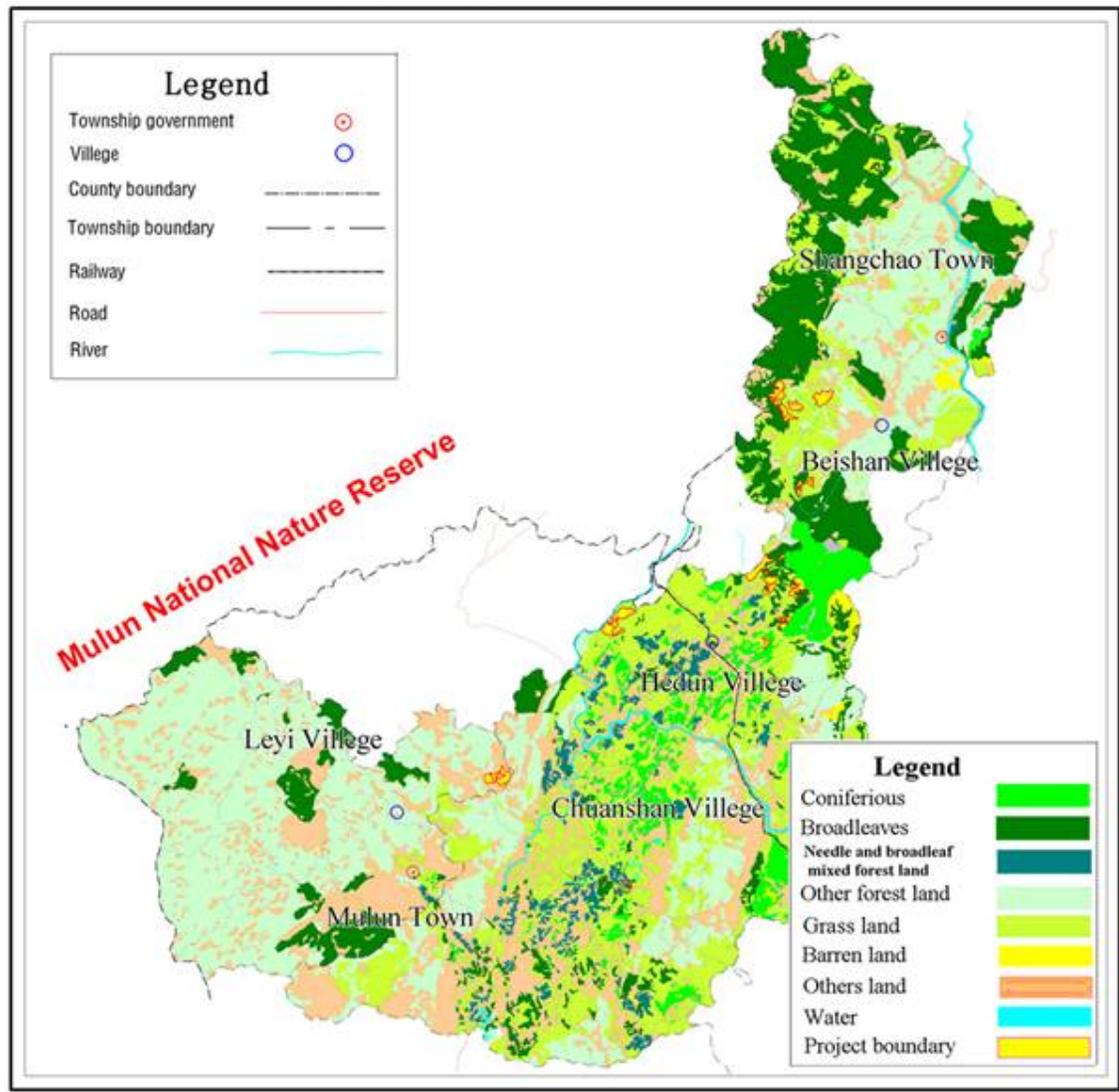Town/Township of Huanjiang County (1:250,000)

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Fig. A-5 Lands to be planted in Mulun, Chuanshan and Shangchao Township
of Huanjiang County (1:250,000)

A.4.1.5. A description of the present environmental conditions of the area, including a description of climate, hydrology, soils, ecosystems, and the possible presence of rare or endangered species and their habitats:

The sites to be planted are distributed in two counties with different environmental conditions, as described here[1]:

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[1] Data sources:

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Geology

Sites in Cangwu County lie in the Hunan-Guangxi folded zone, at the junction of the Dayao Mountain folded-fault belt and Tiantang Mountain folded-fault belt. Based on the geological development history, the strata are divided into 6 systems, namely Cambrian system, Ordovician system, Devonian system, Tertiary system in Cretaceous system, Quaternary system and intrusive rocks. Main types of the rocks are sandy shale, argillaceous shale, meaty sandstone, fine sandstone, meaty-fine sandstone shale, meaty sandstone shale and granite. These rocks are 0.5-1 billion years old and are covered by deep red clay.

The geology in Huanjiang sites can be dated back to Sibao Period of the medium period of the Proterozoic era 1-1.8 billion years ago. The strata from bottom to top are Sibao Group, Danzhou Group, Sinian system, Cambrian system and Permian system, with a total thickness of the strata around 8,000-10,000m.

Landform

Cangwu County is composed mainly of hills and low-median mountains accounting for 77.9% of the total land area, with elevation mostly at 400-600m above sea level. The Yayan peak in the northwest part of Cangwu County is up to1,046 m.

Huanjiang County is the extension of the Yunnan-Guizhou plateau, with the elevation decreasing from north to south. Jiuwandashan Mountain in the east and northeast is the highest area in the County, with the elevation at highest peak of 1,693 m.

Climate

The climate of the project area in Cangwu County belongs to the subtropical monsoon climate. There is a high solar radiation, long and hot summer, and short and warm winter. The mean annual frost-free period is 331 days. Annual mean temperature is 21.2 ^{0}C, with the extreme temperature of 39.9 ^{0}C and -2.4 ^{0}C, and mean annual active accumulated temperature (above 10 ^{0}C) up to 6925.3 ^{0}C. The annual mean precipitation is 1,507 mm, mostly between April and August. The annual mean evaporation is 1,513 mm. The annual mean solar radiation is 112.64 Kcal per square centimetre and the annual mean sunshine is 1,779 hours. The annual mean relative humidity is 80%.

The climate of the project area in Huanjiang County belongs to the transitional monsoon climate between the south subtropical zone and the mid subtropical zone. The southern part is the north edge of south subtropics, while the middle part and the valleys belong to mid-subtropics, with mild climate, rich precipitation and sunshine, and long frost-free period. The north part belongs to mid-subtropical mountainous climate that is cool and moist. Annual mean temperature is 19.9°C, with extreme temperatures of 38.79°C and -5.2°C, and mean annual active accumulated temperature above 10°C of 7,043.3°C. The annual mean precipitation is 1,750 mm in the north and 1,389 mm in the south, 70% occurring between April and September. The annual mean evaporation is 1,571 mm. The annual mean solar radiation is 98.89 Kcal per square centimetre and the annual mean sunshine is 1,451 hours. The annual mean relative humidity is 79%.

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(1) Editorial Board of Huanjiang Annals. Huanjiang County Annals,2001
(2) Editorial Board of Cangwu Annals. Cangwu County Annals, 1996
(3) Guangxi Institute of Forestry Inventory and Design. Overall Planning of Jiuwandashan National Nature Reserve, 2004
(4) Guangxi Institute of Forestry Inventory and Design. Overall Planning of Mulun National Nature Reserve, 2004
(5) Guangxi Institute of Forestry Inventory and Design. Feasibility Studies on Establishment of Filonghu Lake National Forest Park in Cangwu County, 2004
(6) Editorial Board of Guangxi Forests. Guangxi Forests, 2001

Soils

Soils in the southern part of Cangwu County are red earth and yellow-red earth (over 500m above sea level) and crimson earth (below 500m asl), all developed from granite, while sites in the northern part have similar soil types but are developed mainly from sandy shale. Soils developed from granite are subject to soil erosion.

There are six types of soil in Huanjiang County, including red soil, yellow-red soil, yellow soil, brown limestone soil, black limestone soil, etc. They are developed mainly from sandy shale, limestone, sandstone and shale. Yellow soil spreads in the median and low mountains over 800m above sea level, yellow-red soil in the low mountains between 500m and 800m, red soil in the hills and low mountains below 500m.

Ecosystem

There are over 300 tree species from 66 families in the project area. The primary vegetation is mainly the subtropical evergreen broadleaf forest, dominated by Lauraceae and Fagaceae and with some features of seasonal rain forests. However, few primary forests remain. There are plantations of *Pinus massioniana, Cunninghamia laceolata, Pinus elliotii* and bamboo stands. However, lands to be reforested are barren lands covered with shrub and grass, dominated by *Rhodomyrtus tomentosa*, *Melastoma candidum*, *Baeckea frutescens*, *Dicranopteris linearis, Miscanthus floridulus*, *Saccharum fallax*, and ferns.

The Project areas suffered several large scale deforestation events since the 1950s, mainly caused by short-term policies that favoured rapid economic growth at the expense of sustainable forest management. Due to these unsustainable policies, as well as overuse for fuelwood, grazing and frequent fire, and the original forested lands have been severely degraded. In the early 1990s, the government tried to restore forests in the project area in Cangwu by air-seeding, but the action failed. Currently, most sites are seriously degraded and comprise low-productivity barren lands with some grass and shrubs. The only exceptions are a few sites at Shichuan Village and Chantian Village of Shatou Town in Cangwu County on which a few trees are growing. However, the crown cover of these sites is below 20% and will not reach 20% under continuation of current conditions. 20% crown cover is the threshold for defining a forest in China.

Hydrology

There are 6 main rivers in Cangwu County, with over 100 square kilometres of watershed area for each of them. They are Shangxiaohe River, Xiaxiaohe River, Dong'an River, Siliang River, Anping River and Longjiang River, with a total length of 745 km, and a total watershed area of 3,995 square kilometres and annual mean runoff of 30.55 billion cubic meters. All six rivers are the first-order and the second-order branch of the Pearl River.

The main rivers in Huanjiang County are Dahuanjiang River, Xiaohuanjiang River and Dagouhe River, with a length of 147.2 km, 94.1 km and 26 km respectively and watershed areas of 2028.2, 1653.6 and 804 square kilometre, respectively. All of them originate from Guizhou Province and flow from the north to the south of the County. They form the second-order branch of the Pearl River.

Rare and Endangered Species

Close to the project area, there are two national nature reserves, i.e., Mulun and Jiuwandashan Reserves in Huanjiang County.

Landscape linked to Mulun
Nature Reserve (behind)

There are more than 3000 vascular plants in the reserves, and the region is one of the endemic and richest plant diversity centres of China. Many threatened species, such as *Macaca assamensis, Panthera pardus, Moschus berezovskii, Arborophila gingica* and *Python molurus* are recorded in the reserves.

The project area in Cangwu County is surrounded by dense human settlements, and the wildlife habitat has been degraded /destroyed for a long time. The Daguishan National Forest Park is situated in the county and borders the project area in Shatou Township. Another protected area, the Feilinghu Forest Park, will be established in the county. Many state protected species are also found in the forest park with about 1000 plant species in the Daguishan forest park, including 3 species that are listed as first class state key protected species. In recent years, Varanus salvator have been found in the park, and now the local government is establishing a nature reserve to protect its habitat.

Some important wildlife and plant within the nature reserves are shown in pictures below. There are few key protected wildlife within the project boundary.

Manis pentadactyia

Syrmaticus eliiotieliioti

Magnolia septentrionalis

Neofelis nebulosa
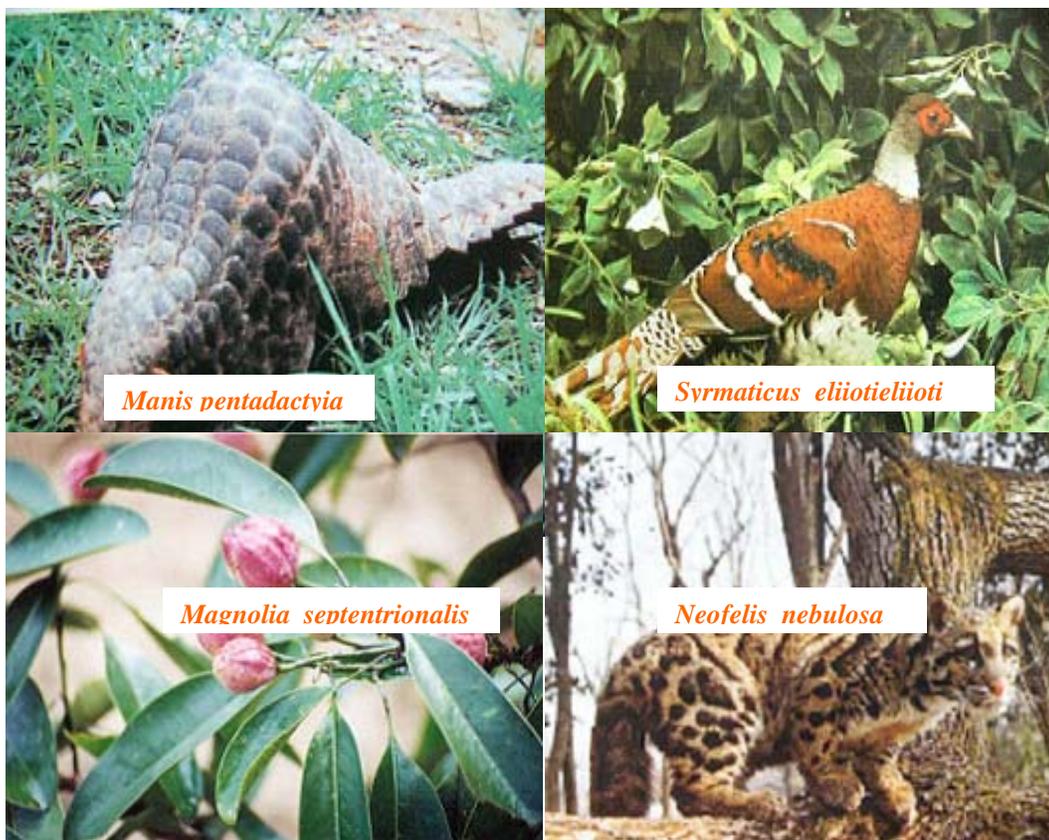
A.4.2. Species and varieties selected:

Tree species to be used have been determined by interviewing local farmers/communities and farms/companies involved, and taking into consideration carbon sequestration rates, biodiversity enhancement, soil erosion control and the value of associated forest products. These species include:

- *Pinus massoniana;*
- *Liquidambar formosana;*

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

- *Cunninghamia lanceolata;*

- *Schima superba;*

- *Eucalyptus* sp.;

- *Quercus* sp.

All species are native to the area except eucalyptus. However eucalyptus was introduced into China about 100 years ago and has been widely planted in Southern China, including in the Guangxi region, for several decades and has shown no invasive characteristics. Eucalyptus was chosen for the project area at the request of local communities who prefer it due to the fact that it can generate a significant amount of CERs in the early stage of the crediting period, compared to other species that grow relatively slow in the first several years.

> **A.4.3. Specification of the greenhouse gases (GHG) whose emissions will be part of the proposed A/R CDM project activity:**

The greenhouse gases (GHG) that are expected to be emitted as a result of the implementation of the proposed A/R CDM project activity are CO_2 and N_2O (table A-3). They result from:

- Fertilization: Due to the low soil fertility and poor adaptation of eucalyptus to poor soils, it is necessary to apply fertilizer to eucalyptus plantations, resulting in N_2O emission; and

- Vehicle use for the transportation of management staff, seedlings, timber and forest by-products, resulting in CO_2 emissions.

- The decrease in carbon stock of non-tree living biomass on the site due to competition from planted trees or site preparation.

Table A-3 List of GHG emission sources

Sources	Gas	Included/ excluded	Justification / Explanation
Burning of fossil fuels	CO_2	Included	
	CH_4	Excluded	Potential emission is negligibly small based on AR-AM0001/version 02
	N_2O	Excluded	Potential emission is negligibly small based on AR-AM0001/version 02
Use of fertilizers…	CO_2	Excluded	Not applicable
	CH_4	Excluded	Not applicable
	N_2O	Included	

Site burning and overall tilling will not be employed during site preparation. No machinery will be used in site preparation, planting, weeding, thinning, harvesting or other management activities. Fertilizer will not be applied to other tree species because they are well adapted and suited for improving poor soils. Therefore no other emissions will occur as a result of the proposed A/R CDM project activity.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

A.4.4. Carbon pools selected:

Decision 11/CP.7 requires parties to account for the carbon stock changes in five pools: aboveground biomass, belowground biomass, dead wood, litter and soil organic carbon[2]. This was reiterated in decision 19/CP.9[3]. The definitions for the five pools are given in the Good Practice Guidance for LULUCF[4]. Based on the decision 19/CP.9, project participants may choose not to account for one or more carbon pools if transparent and verifiable information are provided that the choice will not increase the expected net anthropogenic greenhouse gas removals by sinks.

Carbon stocks in the pools of soil organic carbon, dead wood and litter will not decrease more, nor increase less, as a result of the proposed A/R CDM project activity than in the baseline, since planting trees will be on degraded and/or degrading barren lands that have lower soil organic matter content, little if any dead wood and litter. Therefore, planting trees on degraded barren lands will improve the carbon balance in these other pools relative to the baseline scenario. As a consequence, to be conservative, we choose to account only for the aboveground biomass and belowground biomass in the proposed A/R CDM project activity (table A-4). Other, non-tree vegetation will be treated in a conservative manner by deducting any such pre-existing vegetation as a carbon stock decrease at the beginning of the project.

Table A-4 Selection and justification of carbon pools

Carbon Pools	Selected (answer with yes or no)	Justification / Explanation
Above ground	Yes	Major carbon pool subjected to the project activity
Below ground	Yes	Major carbon pool subjected to the project activity
Dead wood	No	Conservative approach under applicability condition based on AR-AM0001/version 02, see also justification in paragraph above
Litter	No	Conservative approach under applicability condition based on AR-AM0001/version 02, see also justification in paragraph above
Soil organic carbon	No	Conservative approach under applicability condition based on AR-AM0001/version 02, see also justification in paragraph above

A.4.5. Assessment of the eligibility of land:

The Chinese Government defines forests as land having growing trees with:

● A minimum area of 0.067 hectares;

● A minimum tree crown cover of 20%; and

● A minimum height of 2 meters.

Therefore, the threshold values of the forest definition of Chinese government complies with the UNFCCC definition and are to be used for the purposes of the Kyoto Protocol.

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[2] FCCC/CP/2001/13/Add.1, 54~63. http://unfccc.int/resource/docs/cop7/13a01.pdf

[3] FCCC/CP/2003/6/Add.2, 13~31, http://unfccc.int/resource/docs/cop9/06a02.pdf

[4] IPCC. 2003. Good practice guidance for land use, land use change and forestry. The Institute for Global Environmental Strategies (IGES) for the IPCC, Hayama, Kanagawa, Japan. ISBN 4-88788-003-0

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

The land eligibility is demonstrated using *the Procedures to Define the Eligibility of Lands for Afforestation and Reforestation Project Activities* approved by the Executive Board[5].

(a) the land at the moment the project starts is not a forest, which has been demonstrated by

   (i) Field tour studies described in Section B.2.3 indicate that the lands to be planted in the proposed A/R CDM project activity are seriously degraded and comprise low-productivity barren lands covered mostly with grasses and a few shrubs, rather than forests or temporarily unstocked lands. Although a small piece of land has a few growing trees, the tree crown cover of the land is still below 20% of the threshold for defining a forest as communicated by the Chinese DNA, and would remain so under continuation of current management;

   (ii) Most recent land use/cover maps showed in Fig A-6 and Fig A-7 also demonstrates that the lands to be planted are barren lands. The maps were derived from forestry inventory that is conducted once every five years.

(b) the activity is an eligible CDM reforestation project activity, which is demonstrated by

   (i) Interviewing with local farmers/communities on land use/cover history and important events that have impacted the land use/cover (see Section B.2.3) indicates that the lands to be planted in the proposed A/R CDM project activity have been non-forested barren lands since at least 1989 (see Section G as well as Annex 3).

   (ii) Land use/cover maps showed in Fig A-8 and Fig A-9 also demonstrate that the lands to be planted were barren lands in 1989.

Note: the actual GIS systems have a much higher resolution than the pictures inserted in here in the PDD, and have been confirmed by the DOE for the eligibility of lands. The lands to be planted in the proposed A/R CDM project activity are marked with red lines in these figures.

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[5] http://cdm.unfccc.int/EB/Meetings/022/eb22_repan16.pdf

CDM – Executive Board

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

landscape to be planted

land with growing trees

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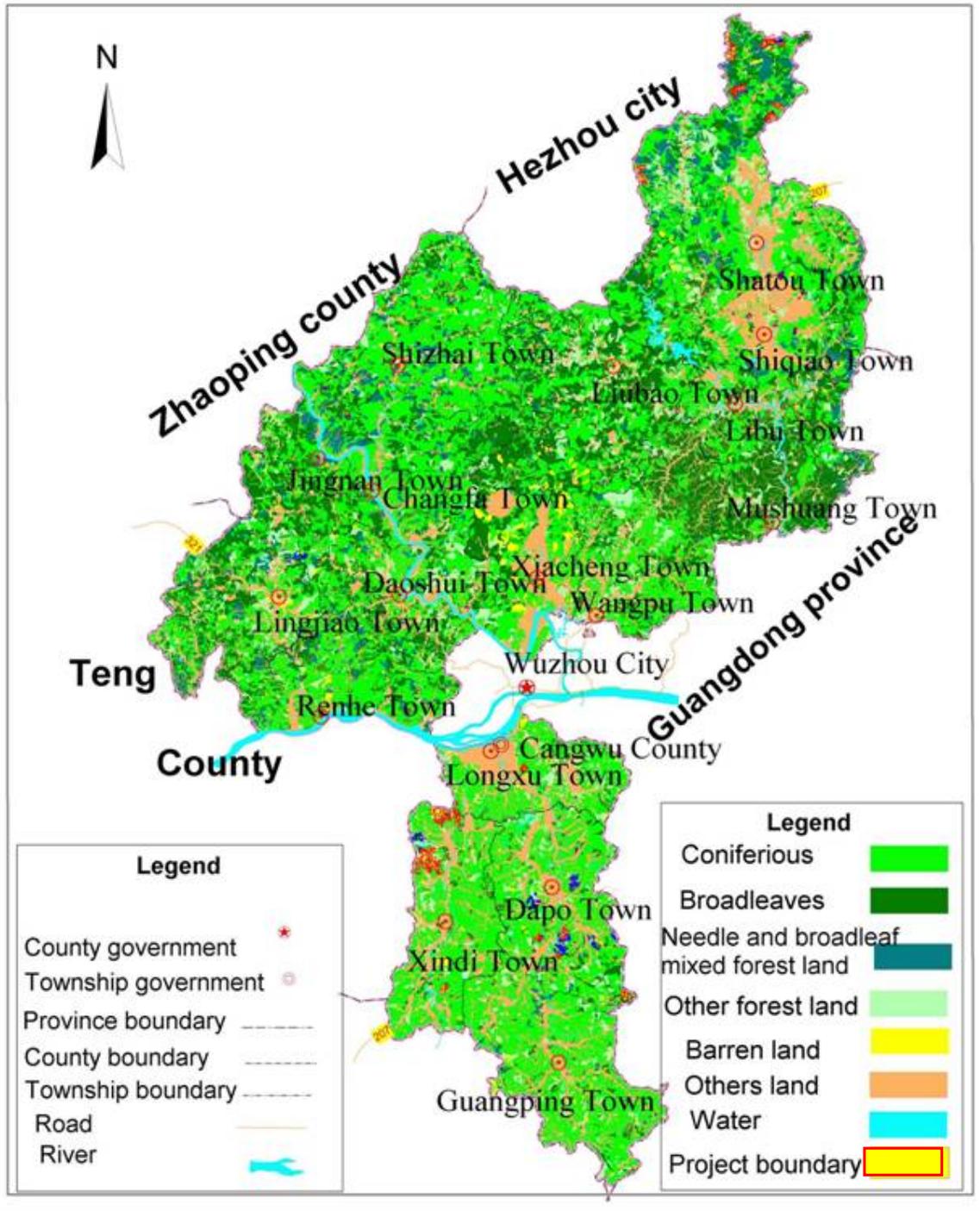Fig. A-6 Land use/cover map of Huanjiang County in 1999 (1:500,000)

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Fig.A-7 Land use/cover map of Cangwu County in 1999 (1:500,000)

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

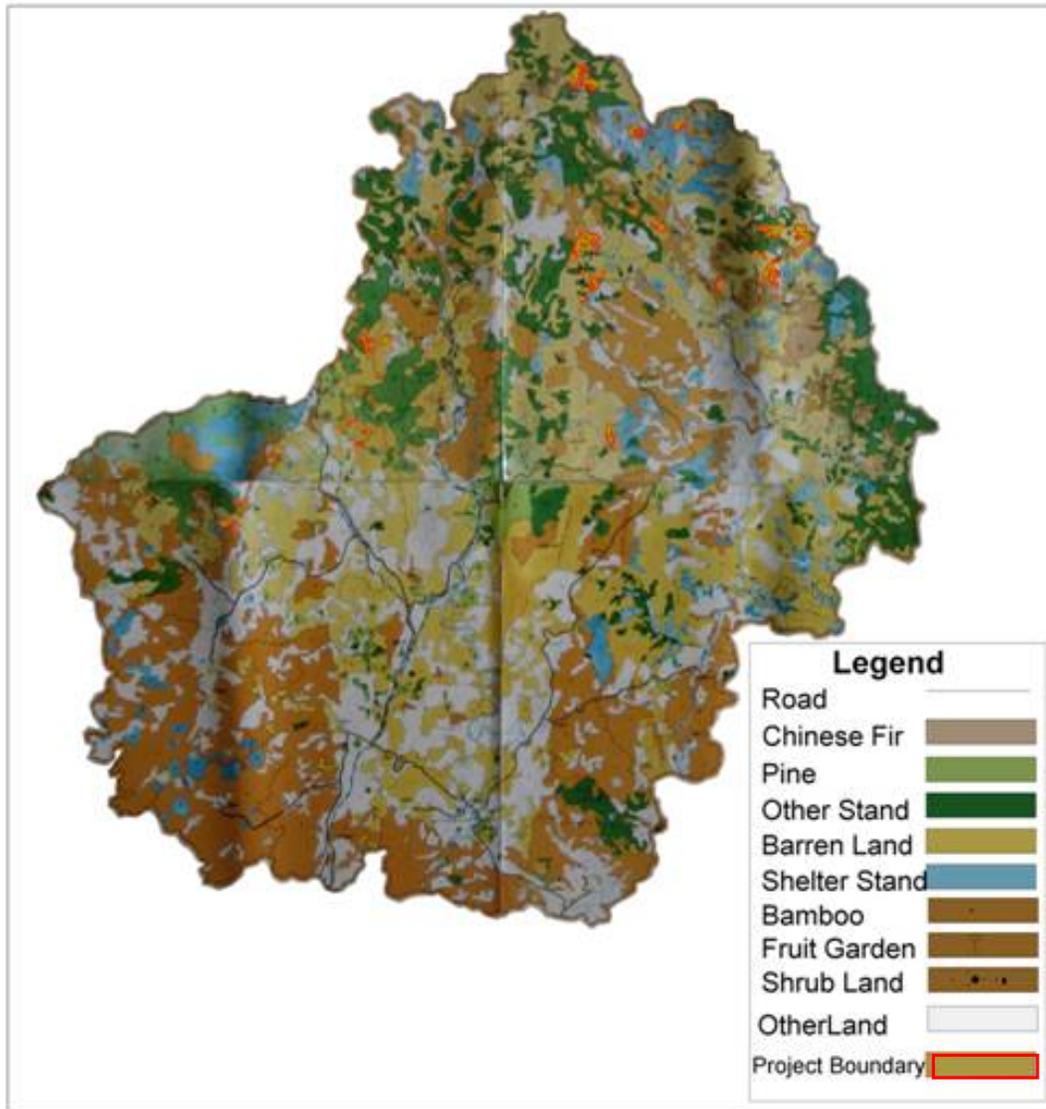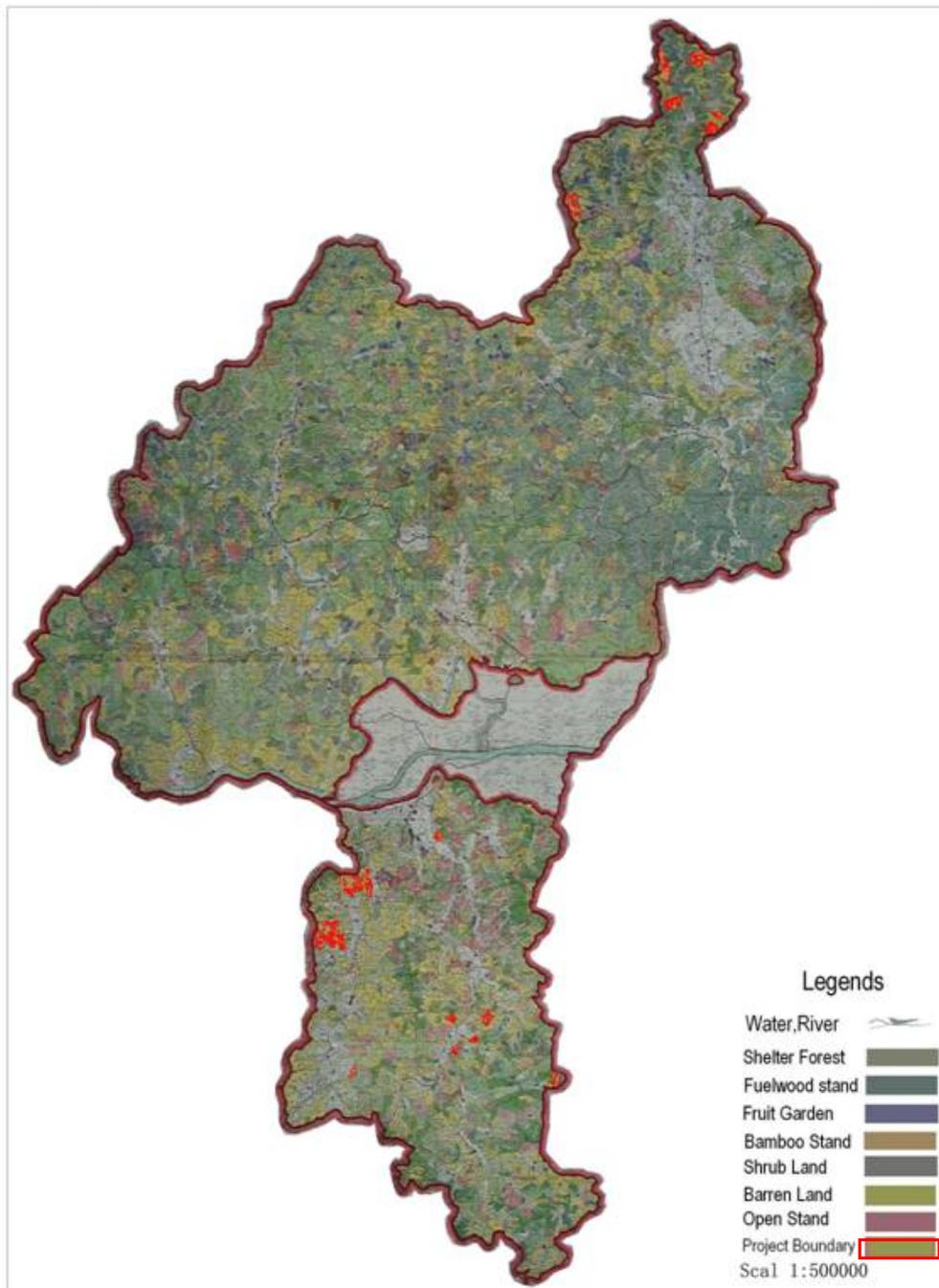Fig.A-8 Land use/cover map of Huanjiang County in 1989 (1:500,000)

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Fig.A-9 Land use/cover map of Cangwu County in 1989 (1:500,000)

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

> **A.4.6. A description of legal title to the land, current land tenure and land use and rights of access to the sequestered carbon:**

Based on the Land Law of the People's Republic of China, the land to be planted in the proposed A/R CDM project activity is legally owned by local villages as a public property. However, the land use right of 1098.4 ha lands within the project boundary in Cangwu County is contracted to local farmers for 50 years and will be renewed upon expiration for another 50 years according to Chinese " Land Contract Law" if farmers apply for. Local farmers have the right to decide themselves how to use the land and own the resources on the land. Other lands to be reforested are still managed by local villages (table A-5). Currently all the land is abandoned barren land.

Table A-5 Land tenure and production arrangement

Counties	Land area within the project boundary (ha)	By land tenures (ha)		By production arrangement (ha)	
		villages	Farmers	Cooperation with company	Farmer groups
Cangwu County	2000.0	901.6	1098.4	1790.3	209.7
Huanjiang County	2000	2000		1775.6	224.4
Project total	4000	2901.6	1098.4	3565.9	434.1

Under the contractual arrangement in the proposed A/R CDM project activity, local farmers/communities and forest farms/companies involved have the right to use the lands. They own the timber and other wood and non-wood forest products, and have the legal right to harvest and sell the products. However, they should have the license, which is issued by the local government, to harvest the timber.

To effectively promote and govern CDM project activities in China, the Chinese government issued the *Measures for Operation and Management of Clean Development Mechanism Projects in China* on Oct 12, 2005, effective immediately. Based on the *Measures*, the Chinese Government allows any sponsor to apply, invest in, and implement a CDM project activity as long as it meets basic requirements stipulated in the *Interim Measures*. The rights of access to the sequestered carbon belongs fully to implementing after Chinese government taxes 2% of transfer value[6].

> **A.4.7. Type(s) of A/R CDM project activity:**

Restoration of natural forest and plantation with harvesting on tropical degraded and degrading land by tree planting. Aboveground and belowground biomass of trees are the carbon pools to be accounted.

> **A.4.8. Technology to be employed by the proposed A/R CDM project activity:**

One of the main technologies which will be employed under this project is reforestation through direct planting with environmental-friendly techniques on degraded lands. Good practice guidance and successful national and international technologies, as well as experiences gained from the World Bank financed forestry projects will also be adopted. The following technical standard will be strictly followed:

- State Technical Regulations for Afforesation/Reforestation: GB/T 15776-1995;
- State Technical Regulations for Establishing Eironmental Service Forests: GB/T 18337.1-2001, GB/T 18337.2-2001, GB/T 18337.3-2001;

[6] http://cdm.ccchina.gov.cn/

- State Technical Regulations for Designing of Afforesation/Reforestation: LY/T 1607-2003;

- State Technical Regulations for Forest Management: GB/T 15781-1995;

- Standards for Seedling Qualification: GB 6000－1999;

- Technical Standard for Seedling Breading.

Geographical Information System (GIS) and Geographical Positioning System (GPS) will be employed in the verification and monitoring of the implementation of the proposed A/R CDM project activity. The local forestry agencies, i.e., Guangxi Provincial Forestry Department, Cangwu and Huanjiang County Forestry Bureaus, Guangxi Forestry Inventory and Design Institute, Guangxi Forestry Research Institute and the Chinese Academy of Forestry will provide technical consultation and guidance, including training courses, and conduct quality control to the preparation and implementation of the proposed A/R CDM project activity. Project participants will also seek advice from local, national, and international forestry and watershed management experts. The most up-to-date technologies and silvicultural models will be adopted, which will also demonstrate the viability of using carbon as a virtual cash crop in the region along Pearl River Basin. No technology will be transferred to the host party.

Site and Soil Preparation

To prevent soil erosion, reduce GHG emission and protect existing carbon stocks, site burning and overall tillage will not be employed during the site preparation. Traditionally in southern China, sites to be planted and/or replanted are usually slashed and burned, followed by overall tillage. As a result, carbon will be released to the atmosphere immediately during burning, along with emissions of non-CO_2 GHGs. Furthermore, due to the steep slopes and overall tillage, severe soil erosion occurs during the rainy season if these practices are employed, and consequently a lot of organic matter and nutrients is removed. Substantial yield decline has been widely reported under this slash and burn system. In the proposed A/R CDM project activity, small holes (diameter 40-50cm and depth 40cm) will be dug along the landform contour in triangle form and most of the original vegetation will be kept. After harvesting, some tree species like *Quercus* sp. and *Eucalyptus* sp will be regenerated naturally by resprouting, thus avoiding site and soil disturbance. Even though, the limited removal of pre-existing vegetation will be accounted as carbon stock decrease.

Species and model arrangements

Tree species will be planted in mixed species arrangements to minimize risks (fire, pest, insects and disease) and maximize environmental and social benefits. For example, *P. massoniana* and *C. lanceolata* that are flammable will be planted on the less accessible upper parts of the slopes; in contrast, broadleaf species that are fire resistant will be planted in lower slopes and/or more accessible areas. Broadleaf

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

species will also be used as firebreaks along hill ridges. Fig. A-10 presents a GIS example of species and planting model arrangement. Table A-6 lists the species and model arrangement.

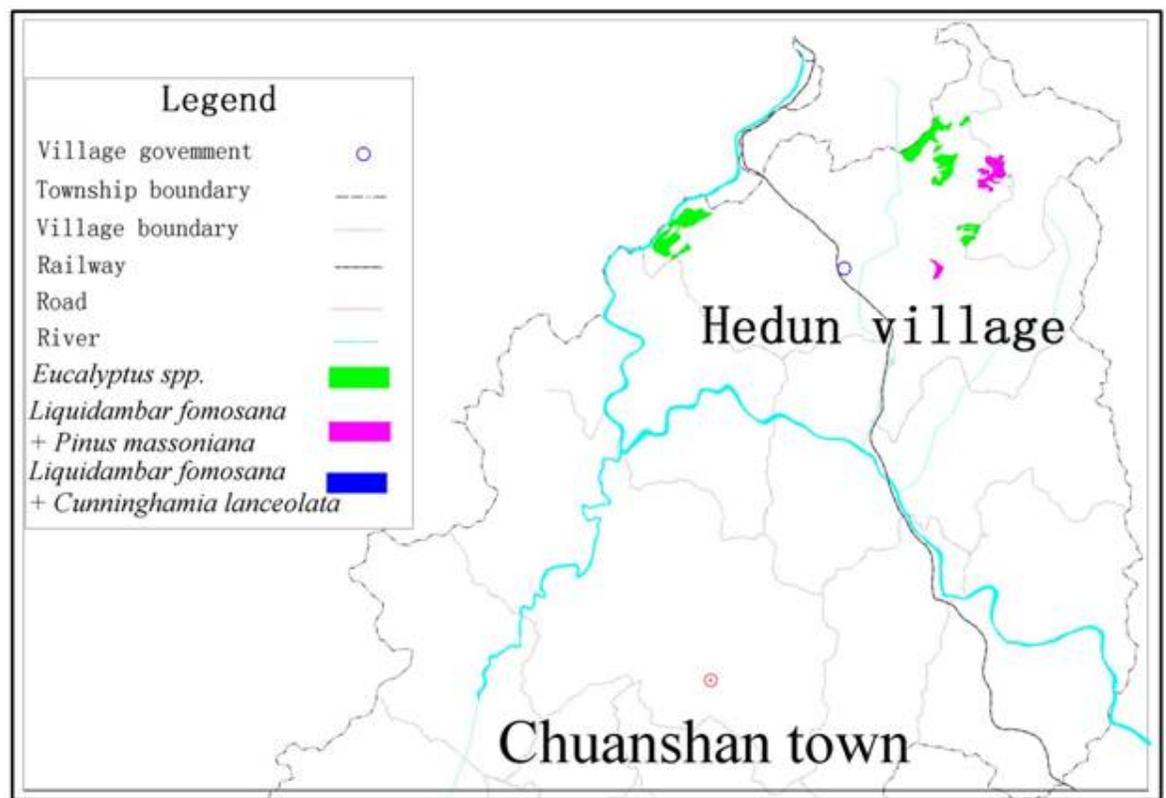Fig. A-10 Species and reforestation model arrangement in Hedun village（1:150,000）

Table A-6 Species and model arrangement and planting plan

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Species/Model	Species ratio	Area to be planted in 2006 (ha)	Area to be planted in 2007 (ha)	Total area (ha)
P. massoniana + Quercus sp.	6:4	100	800	900
P. massoniana + S. superba	6:4	220	380	600
L. formosana + C. lanceolata	6:4		450	450
L. formosana + P. massoniana	6:4	490	560	1,050
Eucalyptus sp.		850	150	1,000
Total		1,660	2,340	4,000

Genetic Sources and Nursery Practices

The tissue culture seedlings of the eucalyptus will be purchased from Guangxi Dongmen Forestry Farm which is close to the project area, and then cultured in the nurseries of Cangwu and Huangjiang Counties.

Seedlings of other species will be generated in temporary on-site nurseries besides streams and irrigated by stream water. Seeds of other species will be collected from local seed orchards or parent tree gardens. All seed and tissue cultured seedlings used will have a quality certificate, quarantine certificate and inspection certificate. Seedlings are produced in plastic tubes that hold soils formed by earth and humus/fertilizers. This technique ensures the control of the growing conditions in the initial stage after planting, and thus increases the survival rate and early growth.

Germinated seedlings plastic tubes in a local nursery

Seedlings produced on-site in temporary nursery

Forest Establishment

Planting activities will last two years, starting in 2006, with spacing as follows:

➢ Eucalyptus: 2 m × 4 m;

➢ *P. massoniana* and *S. superba*: 2 m × 2.5 m;

➢ *Quercus* sp and *C. lanceolata*: 2 m × 2 m;

➢ *L. formosana*: 2 m × 3 m.

To ensure high survival rates and good growth in the

Manual weeding

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

early stages, weed will be slashed manually two to three times a year in the first three years after planting. Survival rates will be checked and re-planting will be conducted 1 month after planting if needed.

Synthetic compound fertilizer with nitrogen content around 10% will be applied to eucalyptus due to its poor adaptation to poor soil conditions: 750g per tree at the time of planting, 300g per tree in the second year and 400g per tree in the third year.

Forest Management

The plantations will not be thinned. However, resin will be collected as a by-product of the *P. massoniana* plantation from 16 to 20 year-old to raise the income of the local communities.

P. massoniana and C. lanceolata will not be harvested during the crediting period. However, *L. formosana* and *S. superba* will be harvested around age 17, eucalyptus around age 10 and oak around age 7. Upon harvesting, Eucalyptus and Oak will be regenerated naturally through re-sprouting and other stands by direct re-planting. The re-sprouted stands grow faster and have many more stems per hectare than other stands.

A.4.9. Approach for addressing non-permanence:

The issuance of tCER for the net anthropogenic GHG removals by sinks achieved by the proposed A/R CDM project activity is chosen.

A.4.10. Duration of the proposed <u>A/R CDM project activity</u> / <u>Crediting period:</u>

30 years, fixed.

A.4.10.1. <u>Starting date of the proposed A/R CDM project activity</u> and of the <u>(first) crediting period,</u> including a justification:

April 1, 2006 is the starting date of the proposed A/R CDM project activity and the crediting period.

A.4.10.2. Expected <u>operational lifetime of the proposed A/R CDM project activity</u>:

30 years

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

A.4.10.3. Choice of <u>crediting period</u> and related information:

30 years, fixed

A.4.10.3.1. <u>Renewable crediting period,</u> if selected:

N/A

A.4.10.3.1.1. Starting date of the first <u>crediting period</u>:

N/A

A.4.10.3.1.2. Length of the first <u>crediting period</u>:

N/A

A.4.10.3.2 <u>Fixed crediting period,</u> if selected:

30 years

A.4.10.3.2 .1. Starting date:

April 1, 2006

A.4.10.3.2.2. Length:

30 years

A.4.11. Brief explanation of how the <u>net anthropogenic GHG removals by sinks</u> are achieved by the proposed <u>A/R CDM project activity,</u> including why these would not occur in the absence of the proposed <u>A/R CDM project activity,</u> taking into account national and/or sectoral policies and circumstances:

Carbon dioxide will be sequestered from the atmosphere through the growth of planted trees and stored in the aboveground biomass and belowground biomass of living trees. Leakage (fossil combustion due to vehicle use), increase in GHG emissions from nitrogen fertilization and carbon stocks decrease from removal of pre-existing non-tree vegetation will occur only on a limited scale (see Table D-1 to D-4 in section D).

Due to the deforestation and subsequent cultivation, overuse for fuel wood, and frequent fires, the project areas have been steadily degrading over the last several decades (see Annex 3 for details). Currently the lands to be reforested within the project boundary are degraded barren lands occupied by grasses and shrubs. In addition there is severe soil and water erosion, and most lands are suffering from continuous human disturbance (fire, fuel collection, etc.). The carbon stocks will continue to decrease or remain at a lower steady state. We chose to set the baseline carbon stock changes for these degraded lands as constant, as far as aboveground and belowground biomass of living trees is concerned. For two sites with a few growing trees, our baseline scenario includes a slight increase in biomass carbon stocks due to the continued growth of these trees. As a result, the baseline net greenhouse gas removal by sinks is very small. Litter and dead wood and soil organic carbon pools are omitted, because their carbon balance is improved in the project scenario compared to the baseline.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Since the land is restricted to forestry purposes and is economically unattractive, the continuation of current situation is the most plausible alternative land use identified. The low land productivity, the investment and technical barriers and market risks prevent local farmers/communities from implementing the type of project activities in the absence of CER revenues.

Therefore, the net anthropogenic greenhouse gas removals by sinks will be achieved only by the proposed A/R CDM project activity, and would not occur without the A/R CDM project activity.

> **A.4.11.1. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:**

The net anthropogenic GHG removals by sinks as a result of the proposed A/R CDM project activity is anticipated to be over 770,000 tones of CO_2 equivalent during the crediting period (between April 1, 2006 and March 31, 2036) per the Table A-7 below.

Table A-7 Ex ante estimated net anthropogenic GHG removals by sinks

Years	Annual estimation of net anthropogenic GHG removals by sinks in tonnes of CO2 e
2006	-40,795
2007	54,394
2008	57,811
2009	57,514
2010	61,788
2011	72,269
2012	77,242
2013	70,250
2014	-31,294
2015	-9,065
2016	-6,310
2017	98,210
2018	78,189
2019	39,417
2020	23,192
2021	74,280
2022	-68,002
2023	-87,056
2024	-95,668
2025	42,423
2026	29,316
2027	81,940
2028	78,583
2029	71,899
2030	-23,701
2031	-77,903
2032	-82,670
2033	78,899
2034	77,319
2035	71,371
Total estimated net anthropogenic GHG removals	773,842

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

by sinks (tonnes of CO2 e)	
Total number of crediting years	30
Annual average over the crediting period of estimated net anthropogenic GHG removals by sinks (tonnes of CO2e)	25,795

Notes: minus sign indicates the source while plus indicates the sink

A.4.12. Public funding of the proposed A/R CDM project activity:

The establishment cost will be from local commercial bank loans, counterpart funds from local government, and the participants themselves. The operating and maintenance cost will be covered by short-term and long-term loans from local commercial banks, counterpart funding from local government and participants (see Annex 2) There is no available public funding that will result in a diversion of official development assistance and financial obligations of any Parties under UNFCCC.

SECTION B. Application of a baseline methodology

B.1. Title and reference of the approved baseline methodology applied to the proposed A/R CDM project activity:

The revised approved afforestation and reforestation baseline methodology "Reforestation of degraded land" (AR-AM0001/version 02)[7] is applied.

B.1.1. Justification of the choice of the methodology and its applicability to the proposed A/R CDM project activity:

The methodology applied was derived from the proposed A/R CDM project activity. The proposed A/R CDM project activity complies with the conditions under which the chosen methodology applies in the following ways:

● The project activity will not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed A/R CDM project activity can continue to provide at least the same amount of goods and services as in the absence of the project activity (see Section B.2.8 below);

● Lands to be reforested have been severely degrading over the last decades and are degrading. Most lands are currently covered by grasses and shrubs, except one piece of land of 35 ha with a few growing trees. But the tree crown cover on this land is below the thresholds for defining a forest set by Chinese DNA that are consistent with decision 11/CP.7 and 19/CP.9, and would not reach the threshold under continuation of current management.

● Unavailability of natural seed sources, and environmental conditions, do not permit the encroachment of natural forest vegetation, which has been demonstrated by failure of air-seeding activities in the early 1990s.

● Lands will be reforested by direct planting in the proposed A/R CDM project activity.

● As elaborated in Section A.4.8 and Section E.1, trees will be planted with low density (1250-2500 trees per hectare), small hole site preparation (40 cm X 50 cm in diameter or 0.2 m^2). As a result,

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[7] http://cdm.unfccc.int/EB/Meetings/024/eb24_repan20.pdf

the surface area disturbed by site preparation is estimated to be 2-5% of the total land surface. Therefore the site preparation will not cause significant long-term net emissions from soil carbon.

- Plantation will be harvested with a minimum rotation of seven years and will be regenerated by direct planting or natural sprouting (see Section A.4.8).

- In the context of degraded and degrading lands, carbon stocks in soil organic matter, litter and deadwood will decrease more or increase less in the absence of the project activity, relative to the project scenario.

- Although livestock were widely raised on some of the project areas until several years ago, currently no farmers raise livestock outside houses and grazing will not occur within the project boundary.

- Due to the degraded feature of the lands, economical unattractiveness, identifiable barriers (unavailable funds, difficult to access commercial bank loans, lack of capacity for successful planting and management on degraded lands, inadequate institutional arrangements) and remote feature of the lands, investors or local communities are prevented from using the land for economic revenue. Without the proposed A/R CDM project activity, the lands to be reforested will continue to degrade. Therefore the baseline approach 22(a) (existing or historical changes in carbon stocks in the carbon pools within the project boundary) is the most appropriate choice for determination of the baseline scenario.

B.2. Description of how the methodology is applied to the proposed A/R CDM project activity:

The revised approved methodology (AR-AM0001/version 02) used by the proposed A/R CDM project activity described the baseline methodology that is followed below.

1. Eligibility of land

The eligibility of lands to be planted is presented under Section A.4.5 above as per the revised Guidelines for CDM-AR-PDD and CDM-AR-NM[8].

2. Project boundary

Lands to be planted are composed of 80 parcels of sites. See Section A.4.1.4 for detail and Annex Spreadsheet for geographical positions (longitude, latitude) at each corner of the 80 parcels of sites. In addition, the emission sources and gases included the project boundary are (see also table A-3):

- CO_2 emissions resulted from burning of fossil fuels due to the transportation of labors, seedlings, wood and non-wood forest products;

- Carbon stock decrease due to loss of pre-existing non-tree vegetation;

- N_2O emission due to fertilizer application.

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[8] Annex 15 (b) - Revised Guidelines for CDM-AR-PDD and CDM-AR-NM, EB 23, Feb 22-24 2006, http://cdm.unfccc.int/EB/Meetings/023/eb23_repan15b.pdf

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

No extra burning of biomass (i.e., manual site preparation rather than site burning) will occur in the proposed A/R CDM project activity (see Section A.4.8), hence there will be no non-CO_2 emission induced from burning of biomass.

3. Ex-ante stratification

The step 1-5 described in Section III.2 of the revised approved methodology AR-AM-0001/version 02 has been followed for the ex-ante stratification through the following activities (see Annex 3 for details):

a) Identifying the factors that influence the carbon stocks in living biomass of trees: The lands to be reforested in the proposed A/R CDM project activity are distributed in two counties that have different climate and landform. Within each county, soil conditions, landform, vegetation, erosion intensity, tree species to be planted and planting time are the major factors that will influence the tree growth.

b) Collecting local information of key factors identified in above, including local site classification maps and/or tables, the most updated land use/cover maps, soil types/maps, parent rocks, landform maps, soil erosion information.

c) Pre-stratification based on the factors such as climate, landform and soil conditions as well as the vegetation (with growing trees versus without growing trees), using land use/cover maps, soil maps, vegetation maps.

d) Field tour studies on each piece of land to inspect the existing vegetation, soil condition and erosion status.

e) Interviews with local farmers/communities on land use/cover history, important events that have impacted or are impacting the land use/cover, and current human interventions (logging, grazing, fuel collecting, medicine collecting, etc).

f) Sampling surveys on representative land types (pre-strata) including the crown cover and mean height for herbaceous, shrubs and trees, soil type, soil depth, and soil sampling and analyzing.

g) Stratifying based on supplementary information gained from field tour study, interview and sampling surveys.

4. Determination of most plausible baseline scenario

The most plausible baseline scenario has been determined with steps presented in Section II.4 of the revised approved methodology AR-AM0001/version 02, "Procedure for selection of most plausible baseline scenario", as follows.

Step 1: Identify and list plausible alternative land uses: The field surveys, interviews with stakeholders (Annex 3 and Section G for details) and social economic analysis indicated that the plausible alternative land uses available to the project participants are either continuation of the current status of the land or forest plantation because the lands to be planted are legally restricted for forestry purposes by government. As a result other land uses, e.g., agriculture, are not allowed.

Step 2: The project areas would remain abandoned and degrading in absence of the project activity because

a) The lands are legally restricted to forestry purposes;

b) The lands have been degrading in last decades (see step 3 paragraph a) below and Annex 3);

c) Natural encroachment of trees is unlikely possible (see step 3 paragraph b) below);

d) In terms of the forestry land uses, the investment analysis indicates that the financial internal return rate (FIRR) without the carbon revenue for the type of proposed A/R project activity is only 8.53% which is much lower than the required rate of return (RRR) by Chinese government (see step 2 of the additionality test in section B.3 for details). In addition, there are apparent investment barriers and other barriers that prevent the implementation of the type of the project activity (see step 3 of the additionality test in section B.3 for detail).

Step 3: Demonstrate that the lands to be planted are really "degraded"

a) Assessment of the historical and existing land use/cover changes

The Project areas were forested lands in the 1950s. However, the areas suffered several large-scale events of deforestation since then, mainly caused by unreasonable policies (see Annex 3 for details). Currently, most sites are seriously degraded barren lands of low productivity with some grasses and shrubs. The only exceptions are a few pieces of lands at Shichuan Village and Chantian Village of Shatou Town in Cangwu County on which a few trees are growing. However, the crown cover of these sites is still below 20% that is the threshold of forest definition in China, and will not exceed 20% with continuation of current management (fuel wood collection, frequent fire, soil erosion).

b) Assessment of the possibility of natural encroachment of trees

The field survey (see Annex 3 for details) indicates that there is no possibility of natural encroachment of trees because there are few if any seed source that can disperse onto the project sites due to the large distance of project lands to adjacent forests. Also, the grass and shrub cover prevents seeds from landing on mineral soil and competes with young seedlings. This has been demonstrated by the failure of previous air seedling[9]. This is also supported by the fact that the lands to be reforested have been non-forested lands at least since 1989 and no natural growth of trees has been identified, even though the land was basically not used by humans for other purposes.

c) Assessment of the national and/or sectoral policies

Since 1980s, China has successively issued and revised a series of laws and administrative regulations related to forestry, such as the Regulations for Implementing the Forest Law, the Regulations for Grain for Green, the Regulations for the Protection of Wild Plants and Animals, the Regulation for Nature Reserve, the Regulation for Forest Fire Control, and the Regulation for Forest Diseases and Pests Control, etc.

In the 1990s, China initiated a policy of "the one who planted trees will be the one to benefit" to encourage afforestation/reforestation on barren lands. The villages owning barren lands were allowed to be contracted with farmers to reforest, with 50-year or even longer contract period. Within this period, the right of using lands will not be changed. The land use contract can be prolonged if the farmers apply for it.

To facilitate the restoration of forest resources, the Chinese government has launched several programs over the past years, such as the Grain for Green Program (started in 2001), the Intensively Managed Timber Plantation Base Program (started in 2000), the Natural Forest Conservation Program (launched in 1998), the Nature Reserve Development and Wild Conservation Program (started in 2000), etc.

Although these programs have set overall development goals for forestry development and were started before the adoption by the COP of the CDM M&P (/decision 17/CP.7, 11 November 2001), they are not legally- or policy-binding, and meeting the goals depends largely on the availability of funds. There is a large financial gap to realize these goals. As the domestic funds for the afforestation/reforestation in this

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[9] The air-seeding design used then has been provided to DOE during the validation process.

region have been limited for many years, and mainly used for planting trees on the economically attractive lands or more accessible lands. The project lands are so remote that they are not attractive for timber markets and are usually not target lands for the reforestation/afforestation programmers. In addition, local farmers/communities are usually not able to fully finance forest establishment because it is difficult for them to get loans from local banks for the purpose of reforestation on remote degraded lands (loans for agricultural activities and reforestation on near and non-degraded economically attractive lands are much easier to obtain).

Therefore, without the proposed A/R CDM project activity the project sites will not be reforested as a result of national or sectoral policies, and with the project activity the on-going reforestation programs will not be reduced.

The step 1-3 clearly demonstrated that the baseline approach 22(a) (existing or historical changes in carbon stocks in the carbon pools with the project boundary) and the scenario "lands to be planted are degraded lands and will continue to degrade in absence of the project" is the most appropriate plausible baseline scenario.

5. Estimation of baseline net GHG removals by sinks

Based on the revised approved methodology AR-AM0001/version 02, the baseline net GHG removals by sinks can be estimated by steps as follow:

a) Determination of the sum of carbon stock changes for each stratum:

- For those strata without growing trees, the sum of carbon stock changes in above-ground and below-ground biomass of living trees is set as zero;

- For stratum II (the only stratum with growing trees), the sum of carbon stock changes in above-ground and below-ground biomass of living trees is determined based on the projection of their number and growth, based on growth models and national or IPCC default parameters using formula in Section II.5 of the revised approved methodology AR-AM0001/version 02 (see in Annex 3).

b) Sum the baseline net GHG removals by sinks across all strata: In the proposed A/R CDM project activity, it is equal to the sum of carbon stock changes in above-ground and below-ground biomass of living trees in stratum II.

6. Additionality

The additionality of the proposed A/R CDM project is demonstrated in Section B.3 for additionality test.

7. Ex ante actual net GHG removal by sinks

Please see section D.1 below for the estimation of the ex-ante actual net GHG removal by sinks.

8. Leakage

As elaboration in Section B.2 paragraph 4 above, lands to be planted in the proposed A/R CDM project activity are abandoned, economically unattractive lands and are legally restricted to forestry purposes. Therefore, as the result of the proposed A/R CDM project activity, agricultural activities will not be displaced from the project sites to other locations.

As elaborated in Section B.3, there is no grazing in the project area, hence as a result of the proposed A/R CDM project activity, grazing activities will not be displaced to land outside the project boundary.

Some villagers are using shrub, grass and/or deadwood and living branches for cooking and/or heating (refer to table F-1 for fuelwood consumption). Local farmers will be able to collect fuel within the project boundary without compromising the growth of trees established under the proposed A/R CDM project activity, including dead wood and branches and grasses/shrubs growing between the trees during the early stages of succession. Therefore, as the result of the proposed A/R CDM project activity, local farmers will not have to collect fuels on lands outside the project boundary.

As elaboration in paragraph 4 c) above, the proposed A/R CDM project activity will not result in any reduction of reforestation activities because of the vast amount of abandoned barren land, majestic governmental goal and financial gap in China. In addition, as the second largest timber import country in the world, China has a severe shortage of timber, therefore market leakage is unlikely to occur.

However, in the context of the proposed A/R CDM project activity, fossil fuel combustion from vehicles using for transporting seedling, labours, fertilizer, harvest products, etc., to and/or from project sites, will emit greenhouse gases. This is estimated based on method described in Section II.8 of the revised approved methodology AR-AM0001/version 02 applied (see section D.3 for detail estimation).

9. Ex ante net anthropogenic GHG removal by sinks

Please see Section D.4 below for the estimation of the ex-ante net anthropogenic GHG removal by sinks.

10. Uncertainties

The uncertainties for baseline net GHG removals by sinks are assessed based on equation (30) and (31) presented in Section III.10 of the revised approved methodology AR-AM0001/version 02 (see Annex 3 paragraph 5 for details).

B.3. Description of how the <u>actual net GHG removals by sinks</u> are increased above those that would have occurred in the absence of the registered <u>A/R CDM project activity</u>:

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

The steps as outlined in the additionality tool[10] are followed to demonstrate that the proposed A/R CDM project activity is additional and not the baseline scenario. Both investment analysis and barrier arguments (steps 2 and 3) are used.

STEP 0: Preliminary screening based on the starting date of the project activity

The proposed A/R CDM project will start in the future on 1 April 2006, and the proof that the land is currently not forest can be found in land eligibility elaborated Section A.4.5.

The incentive of planned sale of GHG emission allowances is evidenced in the steps further below of the additionality test. Without the GHG allowance sales, the project would not be economically attractive, and would face significant barriers. The PIN and PDD were written before the project start, thus clearly demonstrating that the CDM was taken into account in the project planning process.

STEP 0a: Preliminary screening based on the specific features of A/R activity

The land eligibility for the proposed A/R CDM project activity has been proven in land eligibility section above based on forest definition communicated by Chinese DNA, land cover maps in 1989 and 1999, field tour studies and interviewing with local farmers/communities (Section A.4.5).

As elaborated in Section A.4.8 and Section B.1.1, directly planting will be conducted in the proposed A/R CDM project activity. Also as demonstrated in Section B.2, without proposed A/R CDM project activity, the lands to be planted will continue to degrade and would otherwise not convert to forest, and with the project activity through direct planting the lands will convert to forest.

Fire is a risk in the project area, which is usually caused by prescribed burning in cropland. This risk will be mitigated through awareness and technical training, establishment firebreak, mixed species arrangement, and effective patrolling and monitoring.

STEP 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a: Define alternatives to the project activity

Since the lands to be planted are restricted to forestry purposes by governments, other land uses are impossible, therefore the identified alternative land uses are:

  ➢ The proposed project not undertaken as an A/R CDM project;
  ➢ Continuation of current barren lands

Sub-step 1b. Enforcement of applicable laws and regulations

Current laws and/or regulations allow the continuation of the current situation and the reforestation on the degraded lands . Therefore, the identified alternatives are entirely in compliance with applicable legal and regulatory requirements, currently and in the foreseeable future.

Sub-step 1c. Selection of the baseline scenario:

Due to deforestation and subsequent cultivation, fire, fuel wood collection and over grazing, the project areas have been steadily degrading over the last several decades. Currently the lands to be reforested in the project boundary are mostly barren lands occupied by grasses and shrubs. In addition there are severe

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[10] http://cdm.unfccc.int/EB/Meetings/021/eb21repan16.pdf

soil and water erosion, and most lands are suffering from continuous human disturbance (fire, fuel collection, etc.), please see Annex 3 for details.

As elaborated in section B.2 and step 2 and step 3 below, due to the economic unattractiveness as well as the policy restriction on land uses, barriers in finance, technique and institutional barriers and risk, the only realistic and credible alternative available to the project participants is to continue the current degrading land use, so that it remains classified as barren land. In this scenario, natural regeneration will not occur, because dense grass cover (as in the pictures shown above) prevents seeds from landing on the mineral soil and compete with young seedling if any, which has been demonstrated by the failure of previous air-seeding. In addition there are few seed sources that can disperse onto the project sites due to the large pieces of lands without adjacent forests.

Thus, the baseline scenario or the most plausible alternative land use is the continuation of the degraded lands.

STEP 2: Investment analysis

Sub-step 2a. Determine appropriate analysis method

As the identified alternative (continuation of the current degraded land) does not need investments and no economic benefits will be generated, while the project scenario does produce economic benefits from timber harvest and resin production, the benchmark analysis method (Option III) is chosen. The PIN Financial Analysis spreadsheet developed by the World Bank BioCarbon Fund[11] is used to conduct the investment analysis in which FIRR with and without the carbon benefit are the relevant indicators.

Sub-step 2b – Option III: Apply benchmark analysis

The required rate of return (RRR) on equity is 12% for agricultural investment projects based on the standard issued by the Chinese Ministry of Agriculture (CMOA)[12] which is usually applied to forestry projects, and also used in GIFDCP. This means projects can be approved by the government or adopted by forestry enterprises only when their FIRR is expected to be higher than this threshold value. This standard is usually taken as a reference for private investment and commercial forestry projects.

Sub-step 2c. Calculation and comparison of financial indicators.

The FIRR of the proposed A/R CDM project activity was calculated, both without and with carbon finance, and is 8.53% and 15.02% (at $4.00 per tonne of CO_2-e, roughly the price expected to be paid by the BIoCarbon Fund) for the 30 years of the crediting period chosen. When carbon finance was included, the FIRR exceeded the benchmark so that the proposed A/R CDM project activity is financially attractive. When carbon finance was excluded, the FIRR was significantly below the benchmark, so that the proposed A/R CDM project activity is not financially attractive in absence of the sale of carbon credits.

Detailed calculation is summarized as following:

The planting is proposed to be conducted from 2006 to 2007. The planting area for each year and establishment and management costs (US$/ha) in the first 3 years after planting are listed in Table B-1 below. For those areas to be planted in 2007, costs for weeding and fire and disease control will occur through 2008-2009. The preparation cost (180,000 US$) is included in the establishment cost and verification and monitoring cost are included in the operating cost (20,000 US$ annually).

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[11] www.biocarfund.org

[12] Planing Department of CMOA, Planning and Design Institute of CMOA, Standard Institute of the Chinese Ministry of Construction. 1996. Economic Assessment Manual for Agriculture Projects. China Agricultural Publisher

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Table B-1: Costs per step in US$/ha[13]

	Eucalyptus sp.	*P.massoniana* + *Q.* sp.	*P.massoniana* + *S. superba*	*L. formosana* + *P.massoniana*	*L. formosana* + *C.lanceolata*
Planting in 2006 (ha)	850	100	220	490	
Planting in 2007 (ha)	150	800	380	560	450
1 Establishment	**815.89**	**447.71**	**403.71**	**429.30**	**449.70**
1.1 site preparation	160.69	139.06	132.88	122.37	139.06
1.2 seedlings	49.82	82.45	48.33	88.13	88.13
1.3 planting	27.81	40.79	37.08	33.38	37.08
1.4 fertilization (3 years)	346.10	0.00	0.00	0.00	0.00
1.5 fire and disease control (3 years)	16.68	18.54	18.54	18.54	18.54
1.6 weeding (3 years)	213.23	166.87	166.87	166.87	166.87
2 Equipment and infrastructure	**50.68**	**55.62**	**55.62**	**55.62**	**55.62**
2.1 road and protection	35.22	37.08	37.08	37.08	37.08
2.2 tools	14.84	18.54	18.54	18.54	18.54
3 Other costs (designing, training, technical demonstration and consultation, administration, supervision and monitoring, etc)	**70.64**	**58.90**	**58.90**	**58.90**	**58.97**
4 Unpredictable costs (10% of above cost)	**90.95**	**53.67**	**49.27**	**51.83**	**53.87**
5 Total	**1026.00**	**615.92**	**567.51**	**595.65**	**618.09**

The operation costs include harvesting, product (wood and resin) transportation, replanting after harvest, maintenance, administration, fire, pest and disease control, etc. from the 4th year after planting onward until the end of the crediting period. Revenues include income from selling wood, resin and carbon credits. *P. massoniana and C. lanceolata* will not be harvested during the crediting period, but *L. formosana* and *S. superba* will be harvested at age 17, eucalyptus around age 10 and oak at age 7. Upon harvesting, the oak and eucalyptus stands will regenerate naturally through re-sprouting. Resin collection on pine trees will be started at age 16 until age 20. Major parameters for operation cost are listed in Table B-2 below.

Table B-2 Parameters for estimating operating costs and revenues[13]

Items	Eucalyptus	Q. griffithii	S. superba	L. formosana	P. massoniana
	timber	timber	timber	Timber	Timber
Standing volume at harvest (m³/ha)	156.37	27.22/121.53[14]	93.25	93.25	112.38
Timber output ratio	75	60	70	70	70

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[13] Data source: Cost Analysis and Mode of Increasing Ecological Forest Cover for Guangxi Integrated Forestry Development & Conservation Project, 2005

[14] 1st rotation/after 1st rotation

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

(%)					
Timber output at harvest (m^3/ha)	117.28	16.33/72.92	65.28	65.28	78.67
Resin production (t/ha/yr, 16-20 year)					
Labor cost for timber harvesting (US$/m^3)	8.03	8.03	8.65	9.27	9.27
Labor cost for resin collection (US$/t)					
Transportation (timber, US$/m^3)	4.33	4.33	6.18	6.80	6.80
Transportation (resin, US$/t)					
Selling price (timber, US$/m^3)	43.26	30.90	39.56	27.81	42.65
Selling price (resin, US$/t)					
Tax (% of gross income)	10	10	20	20	20

Sup-step 2d: Sensitivity analysis

The most important factors influencing the FIRR for the proposed A/R CDM project activity are the product output, product price and operating costs. The establishment costs are only 12.5% of the total cost (2.82 versus 22.4 million US$) and will occur in the first 3 years. As a result, this cost has a smaller impact on the FIRR. Sensitivity analyses with ±10% variations of the most important factors show that the FIRR without carbon will be below RRR (12%) in the case of (Table B-3)

➢ 10% increase in product output or price, or

➢ 10% decrease in operating cost

And the FIRR with carbon revenue will still be above RRR in the case of

➢ 10% decrease in product output or price, or

➢ 10% increase in operating cost

This infers that the proposed A/R CDM project activity is still economically unattractive in absence of carbon benefit, and is still attractive with carbon revenues, if 10% changes in the key assumptions are assumed.

Table B-3 Sensitive analysis

Parameters	Variation	FIRR (%)	Sensitivity coefficient	Critical points (%)
Without carbon benefit				
Product price	+10%	10.70	2.54	
	-10%	5.98	2.99	
Product Output	+10%	9.83	1.52	

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

	-10%	7.08	1.70	
Operating cost	+10%	6.15	2.79	
	-10%	10.13	1.88	
With carbon benefit				
Product price	+10%	16.91	1.26	
	-10%	12.81	1.47	46.86
Product Output	+10%	16.13	0.74	
	-10%	13.81	0.81	72.15
Operating cost	+10%	13.34	1.12	60.4
	-10%	16.57	1.03	

STEP 3: Barrier analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the type of the proposed project activity:

a) Investment barriers

➢ Income from agricultural production is the main income source for local communities in the project area. However, due to severe soil erosion, agricultural production is subjected to flooding, drought and other disasters. Food productivity is very low and the mean annual income per capita in the project areas is only US$ 145, and even under US$ 100 in some very remote mountainous villages (see table F-1). Under this situation, many farmers still live below the national poverty level. It is hardly possible for local farmers/communities to afford the high plantation establishment investment in the early stage, because all incomes from wood and non-wood products will occur quite some time after the initial investment. On the other hand, carbon credits will provide income already after 4 years following the start of the proposed A/R project activity.

➢ The chances to get commercial loans from banks for the purpose of reforestation on remote degraded land are low (loans for agricultural activities and a few fast-growing species reforestation on non-degraded economically attractive lands nearby are a bit easier to obtain) because of the economical unattractiveness in the context of remote degraded land. With the proposed A/R CDM project activity, the loan from local commercial banks become easier, and the Chinese Government is willing to commit counterpart funding.

In order to promote the integrated forest resource development in Guangxi, the Chinese Government supports Guangxi applying the BioCarbon Fund to support this A/R CDM project activity to improve the watershed management and applying GEF fund to support biodiversity conservation, (which is separated from the A/R CDM project activity and the fund would be used for nature reserve management), which are not economical viable by using the Bank loan. With those funds, the Chinese government then would apply the World Bank loan for expending forest resources (which is also separated from the A/R CDM project activities). The Chinese Government considers that the nature resources only can be managed on the sustainable ways by taking into the forest resource protection and development, as well as biodiversity conservation in an integrated approach within a landscape.

➢ Technological barriers: Interviews with local communities indicate that local farmers/communities are usually short of access to quality seed sources and lack skills for

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

producing high quality seedlings and for successful tree planting, as well as for preventing planted trees from being subject to fire, pest and disease attack. Forestry companies and forestry farms are experienced for reforestation on lands nearby with good conditions but have no experiences on remote degraded lands as all of their previous reforestation activities occurred on lands that are easily accessible and have good site and soil conditions (planting and management are more easier).

b) Institutional barriers: Individual farmer households/communities are too weak to successfully manipulate the chain from investment, production to market especially for the wood and non-wood forest products which will take a much longer period than food production. In addition, the lack of organizational instruments also prevents them from overcoming technological barriers mentioned above. Forest enterprises has less institutional barriers.

c) Market risks: Currently the risks of timber market, are perceived to be high by the project participants because the nature of remote degraded lands with low productivity and high transportation costs, which cause the high cost of the timber production, would largely reduce the marketing competitive capacity. As the price per unit of tCER is guaranteed in the proposed A/R CDM project activity by means of a contract with the World Bank BioCarbon Fund, this provides the certainty of future incomes. Although the market risks do exist for all other afforestation/reforestation projects, the higher productivity of other projects in other areas tends to reduce the risks. In addition, the project participants see the proposed A/R CDM project activity as a "testing ground" for carbon finance business, which further increases their interest to go ahead with the proposed A/R CDM project activity. Without the sale of CER, the basic financial considerations and the risk awareness cited above would drive the decision not to go ahead with the project.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity).

The alternative land use (continued status as waste land) does not face the above-mentioned barriers.

STEP 4: Impact of CDM registration

The approval and registration of the proposed A/R CDM project activity will alleviate economic and financial hurdles, as well as the other identified barriers, and thus enable the proposed A/R CDM project activity to be undertaken and generate the following benefits:

➢ Removals of carbon from the atmosphere, and resulting sale of carbon credits. In absence of the project, carbon stocks in the project areas are expected to decrease or remain at lower steady status due to the continued land degradation.

➢ Attracting participants locally who see this as a testing ground for future carbon finance activities, and are highly motivated to participate in a "learning by doing" exercise regarding carbon monitoring, verification, certification, trading, and carbon project development in general.

➢ Reducing the perceived investment risks of the project activity, by providing a more steady, and guaranteed (fixed purchase price of CO_2) income stream that makes the project more independent from timber market risks and the risks associated with long transport distances from timber markets. The carbon sequestered by the growing trees creates a new 'virtual cash crop' for the participants at a guaranteed price (subject to negotiation with the funding entity upfront), which is secure and thus advantageous to add to the other products (such as wood products) which have an uncertain market price in the future. Income from CERs depends on reaching the growth objectives, whereas income from timber and resin depends both on reaching growth objectives and on a viable market in the

future, including established means of transportation. The cost of the latter is uncertain, and thus the CERs are the only income of the project that can be estimated and expected with a reasonably low market risk. Thus CERs can be seen as the means to ensure the proposed A/R CDM project activity, if timber and resin have a lower market price in the future, at least does not incur a loss. With that, the local farmers/communities are interested in it.

➢ As stated above, local farmers/communities usually cannot afford stand establishment and it is difficult for them to get loans from banks for the purpose of reforestation on remote degraded lands. The proposed A/R CDM project activity with its carbon benefits can make it easier for local farmers/communities and forestry farms to obtain loans from local commercial banks, and the local Government also commit counterpart funding to support the plantation establishment in the remote degraded watersheds.

➢ The proposed A/R CDM project activity will entail close interaction between individuals, communities, forest farms and government to intensify the institutional capacity in linking networks for technical and productive services, and product markets; and

➢ The local forestry agencies as well as companies/farms will organize the training for local communities to extend the improved reforestation technologies such as seed and seedling selection, nursery management, site preparation, planting models and Integrated Pest Management both on-site and off-site.

B.4. Detailed <u>baseline</u> information, including the date of completion of the baseline study and the name of person(s)/entity(ies) determining the <u>baseline</u>:

The detailed baseline information is attached in Annex 3.

Date of completion of Baseline study: 11/25/2005

Name of persons/entity determining the baseline

- Institute of Forest Ecology and Environment, the Chinese Academy of Forestry

    ➢ Dr. Xiaoquan Zhang, xiaoquan@forestry.ac.cn

- Joanneum Research, Austria

    ➢ Dr. Bernhard Schlamadinger, bernhard.schlamadinger@joanneum.at

- Guangxi Forestry Inventory and Design, P.R.China

    ➢ Ms. Zhuping Mo, mzp1968@163.com

- World Bank reviewers

    ➢ Ms Jin Liu, Jliu@worldbank.org

All persons/entity determining the baseline are not the project participant listed in Annex 1.

SECTION C. Application of a <u>monitoring methodology</u> and of a <u>monitoring plan</u>

C.1. Title and reference of <u>approved monitoring methodology</u> applied to the <u>project activity</u>:

The revised approved afforestation and reforestation baseline methodology "Reforestation of degraded land" (AR-AM0001/version 02) is applied.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

C.2. Justification of the choice of the methodology and its applicability to the proposed <u>A/R CDM project activity</u>:

The methodology applied was derived from the proposed A/R CDM project activity. The proposed A/R CDM project activity complies with the conditions under which the chosen methodology applies in the following ways:

- The project activity will not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed A/R CDM project activity can continue to provide at least the same amount of goods and services as in the absence of the project activity (see Section B.2.8 below);

- Lands to be reforested have been severely degrading over the last decades and are degrading. Most lands are currently covered by grasses and shrubs, except one piece of land of 35 ha with a few growing trees. But the tree crown cover on this land is below the thresholds for defining a forest set by Chinese DNA that are consistent with decision 11/CP.7 and 19/CP.9, and would not reach the threshold under continuation of current management.

- Unavailability of natural seed sources, and environmental conditions, do not permit the encroachment of natural forest vegetation, which has been demonstrated by failure of air-seeding activities in the early 1990s.

- Lands will be reforested by direct planting in the proposed A/R CDM project activity.

- As elaborated in Section A.4.8 and Section E.1, trees will be planted with low density (1250-2500 trees per hectare), small hole site preparation (40 cm X 50 cm in diameter or 0.2 m^2). As a result, the surface area disturbed by site preparation is estimated to be 2-5% of the total land surface. Therefore the site preparation will not cause significant long-term net emissions from soil carbon.

- Plantation will be harvested with a minimum rotation of seven years and will be regenerated by direct planting or natural sprouting (see Section A.4.8).

- In the context of degraded and degrading lands, carbon stocks in soil organic matter, litter and deadwood will decrease more or increase less in the absence of the project activity, relative to the project scenario.

- Although livestock were widely raised on some of the project areas until a few years ago, currently no farmers raise livestock outside houses and grazing will not occur in the project boundary.

- Due to the degraded feature of the lands, economical unattractiveness, identifiable barriers (unavailable funds, difficulty to access commercial bank loans, lack of capacity for successful planting and management on degraded lands, inadequate institutional arrangements) and remote feature of the lands, investors or local communities are prevented from using the land for economic revenue. Without the proposed A/R CDM project activity, the lands to be reforested will continue to degrade. Therefore the baseline approach 22(a) (existing or historical changes in carbon stocks in the carbon pools within the project boundary) is the most appropriate choice for determination of the baseline scenario.

C.3. Monitoring of the <u>baseline net GHG removals by sinks</u> and the <u>actual net GHG removals by sinks</u>:

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1. Monitoring of the baseline net GHG removals by sinks

The baseline net GHG removals by sinks do not need to be monitored as per the revised approved methodology AR-AM0001/version 02.

2. Monitoring the boundary of the proposed A/R CDM project activity

● Field survey of the boundary of areas with actual tree planting, site by site. The boundary is half the spacing distance from the last row of planted trees.

● Measuring geographical positions (latitude and longitude of each corner of polygon sites) using GPS.

● Check whether or not the actual boundary is consistent with the description in section A.

● If the actual boundary falls outside of the designed boundary in section A, additional information for the part of lands that are outside the designed boundary in section A will be provided; the eligibility of these lands as a part of the A/R CDM project activity will be justified; and the projected baseline scenario will be demonstrated to be applicable to these lands. Otherwise, these lands will not be accounted as a part of the proposed A/R CDM project activity. Such changes in boundary will be communicated to the DOE and are subject to verification during the project.

● Enter the measured geographical positions into GIS system and calculate the eligible area of each stratum and sub-stratum.

● The project boundary, and the integrity of the planted area, will be monitored periodically through the crediting period. If the boundary is changed during the crediting period, for instance, because deforestation has occurred on the project area, the specific location and area of the deforested land will be identified, the boundary will be modified and reported to DOE for subsequent verifications. The deforested area will then be excluded from the project monitoring. Similarly, if the planting on certain lands within the project boundary fails, and other land uses take the place, these lands will be documented and excluded from the project carbon monitoring.

3. Monitoring of the forest establishment

To ensure the planting quality and confirm the practices described in section A being well-implemented, the following monitoring activities will be conducted in the first three years after planting:

● Confirm that site and soil preparation are implemented based on practice documented in section A, no slash and burn and overall tillage will be used in the site and soil preparation.

● Confirm that site preparation does not cause significant longer term net emissions from soil carbon. This will be done by checking and confirming that site preparation technique described in Section A.4.8 are well implemented. In this case the surface area that has been disturbed through site preparation accounts for only 2-5% of the total surface area, which can infer that there will not be significant longer-term net emissions from soil

carbon.

- Survival checking

  ➢ The initial survival rate of planted trees will be checked within one to three months after the planting, and re-planting will be conducted if the survival rate is lower than 90%.

  ➢ Final survival checking will be carried out three years after the planting.

  ➢ Survival checking will be conducted for each plantation site.

- Weeding checking: to check and confirm that the weeding practice is well-implemented.

- Surveying and checking the area of planted species and planting year for each stratum and sub-stratum.

4. **Monitoring of the forest management**

- Harvesting: location, area, tree species of harvested sites;

- Fertilization: tree species, location, amount and type of fertilizer applied, etc., including fertilization during the first three years after planting;

- Checking and confirming that the harvested sites are re-planted immediately after harvesting if direct planting is used;

- Checking and ensuring that good conditions exist for natural regeneration if harvested lands are regenerated by natural re-sprouting.

C.3.1. Actual net GHG removals by sinks data:

1. Stratification and sampling for ex-post calculations

a) Stratification

The strata built in section B.2.3 (ex-ante stratification) have been further divided into sub-strata in terms of the year to be planted. The stratification map will be created on a GIS platform. However, post stratification will be conducted after the first monitoring event to address the possible changes of project boundary and planting timing in comparison with the project design, and to respond any differences in growth conditions compared to what was expected. The following factors will be considered in the post-stratification:

- Data from monitoring of forest establishment: actual project boundary and planting year;

- Data from monitoring of forest management, e.g., fertilization;

- Variation in carbon stock change for each stratum and sub-stratum after the first monitoring event. Strata or sub-strata will be grouped into one stratum

or substratum if they have similar carbon stock, carbon stock change and spatial variation.

b) Sampling

Permanent sampling plots are used for sampling over time to measure and monitor changes in carbon stocks of the relevant carbon pools. The plots will be located with GPS and are invisible so as to be treated in the same way as other lands within the project boundary, e.g., during site and soil preparation, weeding, fertilization, harvesting, etc., and will be prevented from being deforested over the crediting period.

- **Determining sample size**

As per the revised approved methodology AR-AM0001/version 02, in the proposed A/R CDM project activity, the total sum of samples (n) are estimated as per a criterion of Neyman of fixed levels of accuracy, according to Wenger (1984)[15]:

$$n = \left(\frac{t}{E}\right)^2 \left[\sum_{h=1}^{L} W_h \cdot s_h \cdot \sqrt{C_h}\right] \cdot \left[\sum_{h=1}^{L} W_h \cdot s_h / \sqrt{C_h} \cdot\right] \tag{1}$$

$$n_h = n \cdot \frac{W_h \cdot s_h / \sqrt{C_h}}{\sum_{h=1}^{L} W_h \cdot s_h / \sqrt{C_h}} \tag{2}$$

Where

L = total number of strata
t = t value for a confidence level (95%)
E = allowable error (±10% of the mean)
s_h = standard deviation of stratum h

n_h = number of samples per stratum that is allocated proportional to $W_h \cdot s_h / \sqrt{C_h}$.

$W_h = N_h/N$
N = number of total sample units (all stratum), $N = \sum N_h$

N_h = number of sample units for stratum h, calculated by dividing the area of stratum h by area of each plot
C_h = cost to select a plot of the stratum h

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[15] Wenger, K.F. (ed). 1984. Forestry handbook (2nd edition). New York: John Wiley and Sons.
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The standard deviation of each stratum (s_h) is determined through soil sampling during stratification process (see Annex 3 and Section B.2) as soil conditions are major determinants of tree growth within each stratum. The t value for 95% confidence is approximately equal to 2 when the number of sample plot is over 30. The allowable error is a value on a per-plot basis and is estimated as ±5% of the expected mean biomass carbon stock per plot in living trees at the end of a rotation, which can be estimated as part of the ex-ante estimation of the actual net GHG removals by sinks described in the baseline methodology (see annex 4 for details).

It is possible to reasonably modify the sample size after the first monitoring event based on the actual variation of the carbon stock changes determined from taking the n samples.

- **Randomly locating sampling plots**

To avoid subjective choice of plot locations (plot centres, plot reference points, movement of plot centres to more "convenient" positions), the permanent sample plots will be located systematically with a random start. This will be accomplished with the help of a GPS in the field. The geographical position (GPS coordinate), administrative location, stratum and sub-stratum series number of each plot will be recorded and archived. The size of plots is 400 m^2 (20m X 20m). It is to be ensured that the sampling plots evenly spread as possible.

c) Monitoring frequency

The planting activity will be conducted from 2006 to 2007. *P. massoniana and C. lanceolata* will not be harvested during the crediting period, but *L. formosana* and *S. superba* will be harvested around age 17, eucalyptus around age 10 and oak around age 7. To avoid the coincidence with peaks in carbon stocks, the first monitoring will be conducted in the year 2009 with subsequent monitoring in 2012, 2017, 2022, 2027,2032 and 2037 respectively (see Annex 4). The first verification will be conducted in 2012 and subsequently once every five years.

2. Measuring and estimating carbon stock changes over time

The growth of individual trees on plots shall be measured at each time interval of monitoring. The carbon stock changes in above- and below-ground biomass of non-tree vegetation will not be monitored in the proposed A/R CDM project activity. Should there by any such vegetation at the project start, this will be deducted as an emission. The carbon stock changes in above- and below-ground biomass of living trees on each plot are estimated through Biomass Expansion Factors (BEF) method (see section C.3.1.3.1 below).

3 Monitoring GHG emissions by sources as the results of the A/R CDM project activity

The proposed A/R CDM project activity will result in increase in emissions of nitrous oxide due to nitrogen fertilizer application to eucalyptus plantation. Changes in GHG emissions caused by the nitrogen inputs can be estimated by monitoring activity data and selecting appropriate emission factors (see section C.3.1.3.2 below).

C.3.1.1. Data to be collected or used in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity, and how this data will be archived:

CDM – Executive Board

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

ID number (*Please use numbers to ease cross-referencing to D.3*)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
3.1.1.01	*Stratum ID*	*Stratification map*	*Alpha numeric*		*Before the start of the project*	*100%*	*Electronic and paper*	*Each stratum has a particular combination of soil type, climate, existing vegetation and landform*
3.1.1.02	*Sub-stratum ID*	*Stratification map*	*Alpha numeric*		*Before the start of the project*	*100%*	*Electronic and paper*	*Each sub-stratum has a particular year to be planted under each stratum*
3.1.1.03	*Confidence level*		*%*		*Before the start of the project*	*100%*	*Electronic and paper*	*95% for the purpose of QA/QC and measuring and monitoring precision control*
3.1.1.04	*Precision level*		*%*		*Before the start of the project*	*100%*	*Electronic and paper*	*5% for the purpose of QA/QC and measuring and monitoring precision control*
3.1.1.05	*Standard deviation of each stratum*			e	Before the start of the project	*100%*	*Electronic and paper*	Used for estimating numbers of sample plots of each stratum and substratum
3.1.1.06	*Number of sample plot*			e	Before the start of the project	*100%*	*Electronic and paper*	For each stratum and substratum, calculated from 3.1.1.03-3.1.1.05 using equation (1)-(2)
3.1.1.07	*Sample plot ID*	*Project and plot map*	*Alpha numeric*		*Before the start of the project*	*100%*	*Electronic and paper*	*Numeric series ID will be assigned to each permanent sample plot*
3.1.1.08	*Plot location*	*Project and plot map and GPS locating*		M	5 years	*100%*	*Electronic and paper*	*Using GPS to locate before start of the project and at time of each field measurement*
3.1.1.09	*Tree species*	*Project design map*			5 years	*100%*	*Electronic and paper*	*Arranged in PDD*
3.1.1.10	*Age of*	*Plot*	*year*	M	5 years	*100%*	*Electronic*	*Counted since the planted year*

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

	plantation	*measurement*				*sampling plot*	*and paper*	
3.1.1.11	*Number of trees*	*Plot measurement*	*number*	*M*	*5 years*	*100% trees in plots*	*Electronic and paper*	*Counted in plot measurement*
3.1.1.12	*Diameter at breast height (DBH)*	*Plot measurement*	*cm*	*M*	*5 year*	*100% trees in plots*	*Electronic and paper*	*Measuring at each monitoring time per sampling method*
3.1.1.13	*Mean DBH*	*Calculated*	*cm*	*C*	*5 year*	*100% of sampling plots*	*Electronic and paper*	*Calculated via 3.1.1.11 and 3.1.1.12*
3.1.1.14	*Tree height*	*Plot measurement*	*m*	*M*	*5 year*	*100% trees in plots*	*Electronic and paper*	*Measuring at each monitoring time per sampling method*
3.1.1.15	*Mean tree height*	*Calculated*	*m*	*C*	*5 year*	*100% of sampling plots*	*Electronic and paper*	*Calculated via 3.1.1.11 and 3.1.1.14*
3.1.1.16	*standing volume*	*Calculated using equation (9)-(12)*	$M^3 \cdot ha^{-1}$	*c/m*	*5 year*	*100% of sampling plots*	*Electronic and paper*	*Calculated using equation (9)-(12) via 3.1.1.13 and 3.1.1.15*
3.1.1.17	*Wood density*	*national inventory for LULUCF or direct measuring*	$t\ d.m.\ m^{-3}$	*E*	*Before the first monitoring event*	*100% of species*	*Electronic and paper*	*Species specific*
3.1.1.18	*Biomass expansion factor (BEF)*	*national inventory for LULUCF or direct measuring*	*dimensionless*	*E*	*Before the first monitoring event*	*100% of species*	*Electronic and paper*	*Species specific*
3.1.1.19	*Carbon fraction*	*IPCC or direct measuring*	$t\ C.(t\ d.m)^{-1}$	*E*	*Before the first monitoring event*	*100% of species*	*Electronic and paper*	*IPCC default value or direct measuring*

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

3.1.1.20	Root-shoot ratio	national inventory for LULUCF or direct measuring	Dimensionless	E	Before the first monitoring event	100% of species	Electronic and paper	Species specific
3.1.1.21	Carbon stock in aboveground biomass of plots	Calculated from equation	t C ha^{-1}	C	5 year	100% of sampling plots	Electronic and paper	Calculated using equation (13) via 3.1.1.16-3.1.1.19
3.1.1.22	Carbon stock in belowground biomass of plots	Calculated from equation	t C ha^{-1}	C	5 year	100% of sampling plots	Electronic and paper	Calculated using equation (14) via 3.1.1.20-3.1.1.21
3.1.1.23	Mean Carbon stock in aboveground biomass per unit area per stratum per species	Calculated from plot data	t C ha^{-1}	c	5 year	100% of strata and sub-strata	Electronic and paper	Calculated from 3.1.1.11-3.1.1.21
3.1.1.24	Mean Carbon stock in belowground biomass per unit area per stratum per species	Calculated from plot data	t C ha^{-1}	C	5 year	100% of strata and sub-strata	Electronic and paper	Calculated from 3.1.1.11 and 3.1.1.22
3.1.1.25	Area of stratum and sub-stratum	Stratification map and data	ha	M	5 year	100% of strata and sub-strata	Electronic and paper	Actual area of each stratum and sub-stratum
3.1.1.26	Carbon stock in aboveground biomass of	Calculated using equation (7)	t C	C	5 year	100% of strata and sub-strata	Electronic and paper	Calculated using equation (7) via 3.1.1.23 and 3.1.1.25

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	stratum per species							
3.1.1.27	*Carbon stock in belowground biomass of r stratum per species*	*Calculated using equation (8)*	*t C*	*C*	*5 year*	*100% of strata and sub-strata*	*Electronic and paper*	*Calculated using equation (8) 3.1.1.24and 3.1.1.25*
3.1.1.28	*Carbon stock change in aboveground biomass of stratum per species*	*Calculated using equation (5)*	*t C yr^{-1}*	*C*	*5 year*	*100% of strata and sub-strata*	*Electronic and paper*	*Calculated using equation (5) via 3.1.1.26*
3.1.1.29	*Carbon stock change in belowground biomass of stratum per species*	*Calculated using equation (6)*	*t C yr^{-1}*	*C*	*5 year*	*100% of strata and sub-strata*	*Electronic and paper*	*Calculated using equation (6) 3.1.1.27*
3.1.1.30	*Total carbon stock change*	*Calculated using equation (4)*	*t CO$_2$-e yr^{-1}*	*C*	*5 year*	*100% project area*	*Electronic and paper*	*Summing up carbon stock change in 3.1.1.28 and 3.1.1.29 for all strata, sub-strata and tree species*

C.3.1.2. Data to be collected or used in order to monitor the GHG emissions by the sources, measured in units of CO$_2$ equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
3.1.2.01	*Amount of*	*Monitoring activity*	*kg N ha-1 yr-1*	*m*	*annually*	*100%*	*Electronic and paper*	*For different tree species and/or management intensity*

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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

	synthetic fertilizer N applied per unit area							
3.1.2.02	*Amount of organic fertilizer N applied per unit area*	*Monitoring activity*	*kg N ha-1 yr-1*	*m*	*annually*	*100%*	*Electronic and paper*	*For different tree species and/or management intensity*
3.1.2.03	*area of land with N applied*	*Monitoring activity*	*Ha yr-1*	*m*	*annually*	*100%*	*Electronic and paper*	*For different tree species and/or management intensity*
3.1.2.04	*Amount of synthetic fertilizer N applied*	*Calculated using equation (17)*	*t N yr-1*	*c*	*annually*	*100%*	*Electronic and paper*	*Calculated using equation (17) via 3.1.2.01 and 3.1.2.03*
3.1.2.05	*Amount of organic fertilizer N applied*	*Calculated using equation (18)*	*t N yr-1*	*c*	*annually*	*100%*	*Electronic and paper*	*Calculated using equation (18) via 3.1.2.02 and 3.1.2.03*
3.1.2.06	*Fraction that volatilises as NH3 and NOx for synthetic fertilizers*	*GPG 2000, IPCC Guideline*	*dimensionless*	*e*		*Before start of monitoring*	*100%*	*Electronic and paper*	*IPCC default value (0.1) is used*

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3.1.2.07	*Fraction that volatilises as NH3 and NOx for organic fertilizers*	*GPG 2000, IPCC Guidelines*	*dimensionless*	*e*	*Before start of monitoring*	*100%*	*Electronic and paper*	*IPCC default value (0.2) is used*
3.1.2.08	*Emission factor for emission from N input*	*GPG 2000, IPCC Guidelines*	*N2O-N (tonnes N input)-1*	*e*	*Before start of monitoring*	*100%*	*Electronic and paper*	*IPCC default value (1.25%) is used*
3.1.2.09	*Direct N2O emission of N input*	*Calculated using equation (19)*	*t CO2-e yr-1*	*c*	*annually*	*100%*	*Electronic and paper*	*Calculated using equation (19) via 3.1.2.04-3.1.2.08*
3.1.2.10	*Total increase in GHG emission*	*Calculated using equation (15)*	*t CO2-e yr-1*	*c*	*annually*	*100%*	*Electronic and paper*	*Calculated using equation (15) via 3.1.2.09 and equation (16)*

C.3.1.3. Description of formulae and/or models used to monitor the estimation of the <u>actual net GHG removals by sinks</u>:

The Actual net greenhouse gas removals by sinks represent the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in GHG emissions measured in CO_2 equivalents by the sources that are increased as a result of the implementation of an A/R CDM project activity, while avoiding double accounting, within the project boundary, attributable to the A/R CDM project activity. Therefore,

$$\Delta C_{ACTUAL,t} = \sum_i \sum_j \sum_k \Delta C_{ijk,t} - GHG_{E,t} \tag{3}$$

Where:

$\Delta C_{ACTUAL,t}$ = actual net greenhouse gas removals by sinks, tones CO_2-e yr^{-1} for year t

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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

$\Delta C_{ijk,t}$ = verifiable changes in carbon stock change in carbon pools for stratum i sub-stratum j species k, tonnes CO_2 yr^{-1} for year t.

$GHG_{E,t}$ = increase in GHG emissions by the sources within the project boundary as a result of the implementation of an A/R CDM project activity , tones CO_2-e yr^{-1} for year t.

t = 1 to end of crediting period

C.3.1.3.1. Description of formulae and/or models used to monitor the estimation of the verifiable changes in carbon stock in the carbon pools within the project boundary (for each carbon pool in units of CO_2 equivalent):

Since carbon stock changes in pools of soil organic matter, litter and dead wood are ignored as per the revised approved methodology AR-AM0001/version 02, the verifiable changes in carbon stock equal to the carbon stock changes in above- and below-ground biomass within the project boundary, estimated using equation [16]

$$\Delta C_{ijk,t} = (\Delta C_{AB,ijk,t} + \Delta C_{BB,ijk,t}) \cdot 44/12 \qquad (4)$$

$$\Delta C_{AB,ijk,t} = (C_{AB,m_2,ijk} - C_{AB,m_1,ijk})/T \qquad (5)$$

$$\Delta C_{BB,ijk} = (C_{BB,m_2,ijk} - C_{BB,m_1,ijk})/T \qquad (6)$$

Where

$\Delta C_{ijk,t}$ = verifiable changes in carbon stock in above- and below-ground biomass for stratum i sub-stratum j species k in year t, tonnes CO_2 yr^{-1}

$\Delta C_{AB,ijk,t}$ = changes in carbon stock in aboveground biomass for stratum i sub-stratum j species k in year t, tonnes C yr^{-1}

$\Delta C_{BB,ijk,t}$ = changes in carbon stock in belowground biomass for stratum i sub-stratum j species k in year t, tonnes C yr^{-1}

$C_{AB,m2,ijk}$ = carbon stock in aboveground biomass for stratum i sub-stratum j species k, calculated at time m_2, tonnes C

$C_{AB,m1,ijk}$ = carbon stock in aboveground biomass for stratum i sub-stratum j species k, calculated at time m_1, tonnes C

$C_{BB,m2,ijk}$ = carbon stock in belowground biomass for stratum i sub-stratum j species k, calculated at time m_2, tonnes C

$C_{BB,m1,ijk}$ = carbon stock in belowground biomass for stratum i sub-stratum j species k, calculated at time m_1, tonnes C

$44/12$ = ration of molecular weights of carbon and CO_2, dimensionless

T = number of years between monitoring time m_2 and m_1, T = $m_2 – m_1$, years. It is 3 or 5 years in the proposed A/R CDM project activity

The total carbon stock in above- and below-ground biomass for each stratum and sub-stratum in each monitoring time (m) is calculated from the area of each stratum and sub-stratum and mean carbon stock in above- and below-ground biomass per unit area, given by:

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[16] Refers to GPG-LULUCF Equation 3.2.3

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

$$C_{AB,m,ijk} = A_{ijk} \cdot MC_{AB,m,ijk} \qquad (7)$$

$$C_{BB,m,ijk} = A_{ijk} \cdot MC_{BB,m,ijk} \qquad (8)$$

Where

$C_{AB,m,ijk}$ = carbon stock in aboveground biomass for stratum i sub-stratum j species k, calculated at monitor time m, tonnes C

$C_{BB,m,ijk}$ = carbon stock in belowground biomass for stratum i sub-stratum j species k, calculated at monitor time m, tonnes C

A_{ijk} = area of stratum i sub-stratum j species k, hectare (ha)

$MC_{AB,m,ijk}$ = mean carbon stock in aboveground biomass per unit area for stratum i sub-stratum j species k at monitor time m, tonnes C ha^{-1}

$MC_{BB,m,ijk}$ = mean carbon stock in belowground biomass per unit area for stratum i sub-stratum j species k at monitor time m, tonnes C ha^{-1}

The mean carbon stock in above- and below-ground biomass per unit area is estimated based on field measurements on permanent plots using the Biomass Expansion Factors (BEF) method, with specific steps as follows:

Step 1: Measuring the diameter at breast height (DBH, at 1.3 m above ground) and preferably height of all the trees in the permanent sample plots above a minimum DBH (2 cm).

Step 2: Estimating the standing volume of trees based on following locally derived equations[17,18].

Pinus massoniana：$\qquad V = 0.0000714265437 \cdot DBH^{1.867010} \cdot H^{0.9014932}$ $\qquad\qquad$ (9)

Cunninghamia lanceolata: $\qquad V = 0.000065671 \cdot DBH^{1.769412} \cdot H^{1.069769}$ $\qquad\qquad$ (10)

Eucalyptus sp.: $\qquad V = 0.000109154145 \cdot DBH^{(C_1 - C_2 \cdot (DBH+H))} \cdot H^{(C_3 + C_4 \cdot (DBH+H))}$ $\qquad\qquad$ (11)

Other tree species: $\qquad V = 0.0000667054 \cdot DBH^{1.8479545} \cdot H^{0.96657509}$ $\qquad\qquad$ (12)

Where

V = standing volume, cubic meter (m^3)
DBH = diameter at breast height, centimetre (cm)
H = tree height, meter (m)

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[17] Forestry Inventory Manule. 1986. Guangxi Institute of Forestry Inventory and Design

[18] Yield Table of Eucalyptus. 2005. Guangxi Institute of Forestry Inventory and Design

$c_1 = 1.87892370$
$c_2 = 5.69185503 \times 10^{-3}$
$c_3 = 0.65259805$
$c_4 = 7.84753507 \times 10^{-3}$

Step 3: Choosing BEF, wood density, root-shoot ratio and other parameters: Parameters from China's Initial National Communication for Land Use Change and Forestry Sector are used in the estimation (Table C-1). These parameters are estimated from published data. However, the average value of BEF may result in significant errors because BEF usually decreases with the increase of plantation age. Therefore database will be analyzed to derive age-dependent equations for BEF. If the equations are not possible to be developed, local allometric equations or parameters for the project use will be developed. For this, sample of trees, representing different size classes, is destructively harvested, and its above- and below-ground biomass is determined. The number of trees to be destructively harvested and measured depends on the range of size classes and number of species—the greater the heterogeneity the more trees are required. IPCC default value (0.5) for the carbon fraction is used.

Table C-1 Wood density, BEF and Root-shoot ratio for species used in the proposed A/R CDM project activity[19]

Tree species	Wood Density (tonnes d.m.m^{-3} standing volume)	BEF	Root-shoot ratio
Pinus massoniana	0.380 (43, 0.019)	1.46 (103, 0.47)	0.283 (77, 0.043)
Cunninghamia lanceolata	0.307 (54, 0.009)	1.53 (237, 0.27)	0.255 (237, 0.040)
Eucalyptus sp.	0.578 (104, 0.019)	1.48 (82, 0.38)	0.201 (37, 0.065)
Quercus sp.	0.676 (82, 0.012)	1.54 (73, 0.46)	0.340 (65, 0.082)
Schima superba	0.598 (482, 0.012)	1.79 (120, 0.36)	0.217 (94, 0.075)
Liquidambar formosana	0.443 (189, 0.013)	1.54 (21, 0.36)	0.283 (14, 0.088)

Note: data in parentheses represent number of samples and standard deviation respectively

Step 4: Converting the standing volume of trees into carbon stock in above- and below-ground biomass via basic wood density, BEF root-shoot ratio and carbon fraction, given by equations 9 and 10 of the revised approved methodology AR-AM0001/version 02 [20]:

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[19] Institute of Forest Ecology and Environment, CAF, Report of the GHG Inventory in Forestry Sector,2005.
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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

$$MC_{AB} = V \cdot D \cdot BEF \cdot CF \qquad (13)$$

$$MC_{BB} = MC_{AB} \cdot R \qquad (14)$$

where:

MC_{AB} = mean carbon stock in aboveground biomass, tonnes C ha^{-1}
MC_{BB} = mean carbon stock in belowground biomass, tonnes C ha^{-1}
V = standing volume, m^3 ha^{-1}
D = volume-weighted average wood density, tonnes d.m. m^{-3} standing volume
BEF = biomass expansion factor for conversion of biomass of standing volume to aboveground biomass, dimensionless
CF = carbon fraction, tones C (tonne d.m.)$^{-1}$, IPCC default value = 0.5
R = Root-shoot ratio, dimensionless

> **C.3.1.3.2. Description of formulae and/or models used to monitor the estimation of the GHG emissions by the sources, measured in units of CO$_2$ equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary (for each source and gas, in units of CO$_2$ equivalent):**

The following emission sources will occur as a result of the proposed A/R CDM project activity:

● Decrease in carbon stock in living biomass of existing non-tree vegetation, caused either by competition of planted trees or site preparation including slash and burn;

● N$_2$O emissions caused by nitrogen fertilization application.

The GHG emission as a result of the implementation of the proposed A/R CDM project activity within the project boundary is estimated as follows (equation 13 in AR-AM0001/version 02):

$$GHG_{E,t} = E_{biomassloss,t} + N_2O_{direct-N_{fertilizer},t} \qquad (15)$$

Where

GHG$_{E,t}$ = the GHG emissions as a result of the implementation of the A/R CDM project activity within the project boundary in year t, tonnes CO$_2$-e yr^{-1}

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[20] Refers to GPG LULUCF Equation 4.3.1
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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

$E_{biomassloss,t}$ = the CO2 emissions as a result of a decrease in carbon stock in living biomass of existing non-tree vegetation in year t, tonnes CO_2-e. This is an initial loss, and therefore accounted once upfront as part of the first monitoring interval, not per year.

$N_2O_{direct-N_{fertilizer},t}$ = N_2O emissions as a result of direct nitrogen application within the project boundary in year t, tonnes CO_2-e yr^{-1}

A) Calculation of the decrease in carbon stock in living biomass of existing non-tree vegetation

It is assumed that all existing non-tree vegetation will disappear due to site preparation or competition from planted trees. This is a conservative assumption because there will be some non-tree vegetation in the project scenario.

Step 1: Measuring and estimating the above- and below-ground biomass of existing non-tree vegetation. This task shall be conducted before the start of project activity. The herbaceous plants can be measured by simple harvesting techniques. A small frame (either circular or square), usually encompassing about 0.5-1.0 m2 or less, is used to aid this task. The material inside the frame is cut to ground level and weighed, and the underground part is also dug and weighed. Well-mixed samples are then collected and oven dried to determine dry-to-wet matter ratios. These ratios are then used to convert the entire sample to oven-dry matter. For shrubs, destructive harvesting techniques can also be used to measure the living biomass. An alternative approach, if the shrubs are large, is to develop local shrub allometric equations based on variables such as crown area and height or diameter at base of plant or some other relevant variable (e.g., number of stems in multi-stemmed shrubs). The equations would then be based on regressions of biomass of the shrub versus some logical combination of the independent variables. The independent variable or variables would then be measured in the sampling plots (Refers to Chapter 4.3 in GPG LULUCF).

Step 2: Estimating decrease in carbon stock of existing non-tree vegetation (equation 15 in AR-AM0001/version 02)

$$E_{biomassloss,t} = \sum_i A_i \cdot B_{non-tree,i} \cdot CF_{non-tree} \cdot 44/12 \qquad \forall_t = 1 \qquad\qquad (16)$$

$$E_{biomassloss,t} = 0 \qquad \forall_t > 1$$

Where
$E_{biomassloss,t}$ = Decrease in carbon stock in living biomass of existing non-tree vegetation tones CO_2-e yr^{-1} in year *t*
A_i = area of stratum *i*, ha
$B_{non-tree,i}$ = average biomass stock of non-tree vegetation on land to be planted before the start of a proposed A/R CDM project activity for stratum *i*, tonnes d.m. ha^{-1}
$CF_{non-tree}$ = the carbon fraction of dry biomass in non-tree vegetation, tonnes C (tonne d.m.)$^{-1}$
44/12 = ration of molecular weights of CO2 and carbon, dimensionless

B) Nitrous oxide emissions from nitrogen fertilization practices

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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

The proposed A/R CDM project activity will result in increase in emissions of nitrous oxide due to nitrogen fertilization practices to eucalyptus plantation. Only direct N_2O emissions from nitrogen fertilization are monitored and estimated as per the revised approved methodology AR-AM0001/version 02, because indirect N_2O emissions (e.g., leaching and runoff) are smaller in forest than in agricultural land and the emission factor used in the 1996 IPCC Guidelines appears to be high (GPG LULUCF). The method of 1996 IPCC Guideline, GPG-2000 and GPG LULUCF can be used to estimate the direct N_2O emissions.

Step 1: Monitoring and estimating the amount of synthetic and organic fertilizer nitrogen used within the project boundary during monitoring interval (equations 20 and 21 in AR-AM0001/version 02):

$$N_{SN-Fert,t} = \sum_k A_k \cdot N_{SN-Fert,k,t} \cdot 0.001 \tag{17}$$

$$N_{ON-Fert,t} = \sum_k A_k \cdot N_{ON-Fert,k,t} \cdot 0.001 \tag{18}$$

Where

$N_{SN-Fert,t}$ = total use of synthetic fertiliser within the project boundary, tonnes N yr^{-1} in year *t*;
$N_{ON-Fert,t}$ = total use of organic fertiliser within the project boundary, tonnes N yr^{-1} in year *t*;
A_k = area of tree species *k* with fertilization, ha yr^{-1}
$N_{SN-Fert,k,t}$ = use of synthetic fertiliser per unit area for tree species *k*, kg N ha^{-1} yr^{-1} in year *t*;
$N_{ON-Fert,k,t}$ = use of organic fertiliser per unit area for tree species *k*, kg N ha^{-1} yr^{-1} in year *t*;
0.001 = conversion kg N to tonnes N.

Step 2: Calculating direct N_2O emissions from nitrogen fertilization (equations 22, 23 and 24 in AR-AM0001/version 02):[21]

$$N_2O_{direct-N_{fertilizer},t} = \left[(F_{SN,t} + F_{ON,t}) \cdot EF_1 \right] \cdot 44/28 \cdot GWP_{N_2O} \tag{19}$$

$$F_{SN,t} = N_{SN-Fert,t} \cdot (1 - Frac_{GASF}) \tag{20}$$

$$F_{ON,t} = N_{ON-Fert,t} \cdot (1 - Frac_{GASM}) \tag{21}$$

Where:

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[21] Refers to Equation 3.2.18 in IPCC GPG-LULUCF, Equation 4.22 and Equation 4.23 in GPG-2000
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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

$N_2O_{direct-N_{fertilizer},t}$ = the direct N_2O emission as a result of nitrogen application within the project boundary during monitoring interval, tonnes CO_2-e yr^{-1}

in year t

$F_{SN,t}$ = Amount of synthetic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NOx, tonnes N yr^{-1} in year t

$F_{ON,t}$ = Annual amount of organic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NOx, tonnes N yr^{-1} in year t

$N_{SN-Fert,t}$ = Amount of synthetic fertilizer nitrogen applied, tonnes N yr^{-1} in year t

$N_{SN-Fert,t}$ = Amount of organic fertilizer nitrogen applied, tonnes N yr^{-1} in year t

EF_1 = Emission factor for emissions from N inputs, tonnes N_2O-N (tonnes N input)$^{-1}$, IPCC default value = 1.25%

$Frac_{GASF}$ = the fraction that volatilises as NH3 and NOx for synthetic fertilizers, dimensionless, IPCC default value = 0.1;

$Frac_{GASF}$ = the fraction that volatilises as NH3 and NOx for organic fertilizers, dimensionless, IPCC default value = 0.2;

$44/28$ = ration of molecular weights of N_2O and nitrogen, dimensionless

GWP_{N2O} = Global Warming Potential for N_2O, kg CO_2e (kg N_2O)$^{-1}$ (IPCC default = 310, valid for the first commitment period)

The default values of GPG 2000 and 1996 IPCC Guideline are used for relevant parameters[22].

C.3.2. As appropriate, relevant data necessary for determining the <u>baseline net GHG removals by sinks</u> and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to D.3)*	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**

C.3.2.1. Description of formulae and/or models used to monitor the estimation of the <u>baseline net GHG removals by sinks</u> (for each carbon pool, in units of CO_2 equivalent):

Monitoring of the baseline net GHG removals by sinks is not needed, see section B and revised approved methodology AR-AM0001/version 02 applied.

C.4. Treatment of <u>leakage</u> in the monitoring plan:

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[22] Refers to table 4-17 and table 4-18 in 1996 IPCC Guideline

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As elaborated in Section B.2 paragraph 8, fossil fuel combustion from vehicles using for transporting seedling, labours, fertilizer, harvest products, etc., to and/or from project sites, as a result of the proposed A/R CDM project activity, will emit greenhouse gases. This can be monitored and estimated using IPCC bottom-up approach.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

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C.4.1. If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed <u>A/R CDM project activity</u>:								
ID number *(Please use numbers to ease cross-referencing to D.3)*	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
4.1.01	*Number of each vehicle type used*	*Monitoring of project activity*	*number*		*annually*	*100%*	*Electronic and paper*	*Monitoring number of each vehicle type used*
4.1.02	*Emission factors for road transportation*	*GPG 2000, IPCC Guidelines, national inventory*	*kg CO2-e l-1*	*e*	*annually*	*100%*	*Electronic and paper*	*Value from National GHG inbentory*
4.1.03	*Kilometres travelled by vehicles*	*Monitoring of project activity*	*km*	*m*	*annually*	*100%*	*Electronic and paper*	*Monitoring kilometres for each vehicle type and fuel type used*
4.1.04	*Fuel consumption per km*	*Local data, national data, IPCC*	*Litre km-1*	*e*	*5 years*	*100%*	*Electronic and paper*	*Value from National GHG inbentory*
4.1.05	*Fuel consumption for road transportation*	*Calculated using equation (23)*	*litre*	*c*	*annually*	*100%*	*Electronic and paper*	*Calculated using equation (23) via 4.1.07, 4.1.03, 4.1.04*
4.1.06	*Leakage due to vehicle use for transportation*	*Calculated using equation (22)*	*t CO2-e yr-1*	*c*	*annually*	*100%*	*Electronic and paper*	*Calculated using equation (22) via 4.1.02, 4.1.07*

C.4.2. Description of formulae and/or models used to estimate <u>leakage</u> (for each GHG, source, <u>carbon pool</u>, in units of CO₂ equivalent:

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As per the revised approved methodology AR-AM0001/version 02, leakage due to fossil fuel combustion from vehicles will be estimated using the following steps and formula

Step 1: Collecting the transportation distance of different types of vehicles using different fuel types. The commonly used vehicle in the project area is mid-size vehicle burning diesel.

Step 2: Determining emission factors for different types of vehicles using different fuel types. National default values from national GHG inventory will be used, e.g., 2.6353kg CO_2 per litre of diesel for mid size vehicles that commonly used by local farmers. The diesel consumption is 12 litre per 100 km.

Step 3: Estimating the GHG emissions using bottom-up approach described in GPG 2000 for energy sector (equations 25 and 26 in AR-AM0001/version 02)[23].

$$LK_t = \sum_i \sum_j (EF_{ij} \cdot FuelConsumption_{ij,t}) \cdot 0.001 \qquad (22)$$

$$FuelConsumption_{ij,t} = n_{ij,t} \cdot k_{ij,t} \cdot e_{ij,t} \qquad (23)$$

Where

LK_t = total GHG emissions due to fossil fuel combustion from vehicles, tonnes CO_2-e yr^{-1} in year t
i = vehicle type
j = fuel type
EF_{ij} = emission factor for vehicle type i with fuel type j, kg CO_2-e l^{-1}, 2.6353 kg CO2 l^{-1}
$FuelConsumption_{ij,t}$ = consumption of fuel type j of vehicle type i, litre yr^{-1} in year t
$n_{ij,t}$ = number of vehicle type i used, yr^{-1} in year t
$k_{ij,t}$ = kilometres travelled by each of vehicle type i with fuel type j, km in year t
$e_{ij,t}$ = average litres consumed per kilometre travelled for vehicle type i with fuel type j, litre km^{-1} in year t

---

C.4.3. Please specify the procedures for the periodic review of implementation of activities and measures to minimize <u>leakage</u>:

Leakage associated with the proposed A/R CDM project activity, in terms of the use of vehicles for the transportation of staff and products outside the project area, is small. This leakage will be monitored regularly and accounted using steps described in section C.4.2.

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[23] Refer to Equation 2.5 and Equation 2.6 in IPCC GPG 2000 for energy sector
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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

C.5. Description of formulae and/or models used to estimate <u>net anthropogenic GHG removals by sinks</u> for the proposed <u>A/R CDM project activity</u> (for each GHG, <u>carbon pool</u>, in units of CO$_2$ equivalent):

The net anthropogenic GHG removals by sinks is the actual net GHG removals by sinks minus the baseline net GHG removals by sinks minus leakage. Therefore, following general formula (equation 27 in AR-AM0001/version 02). can be used to calculate the net anthropogenic GHG removals by sinks of an A/R CDM project activity (C$_{AR-CDM}$), in tonnes CO$_2$-e yr^{-1}:

$$C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t \qquad (24)$$

Where

$\Delta C_{ACTUAL,t}$ = actual net GHG removals by sinks, tonnes CO$_2$-e yr^{-1} in year t
$\Delta C_{BSL,t}$ = baseline net GHG removals by sinks, tonnes CO$_2$-e yr^{-1} in year t
LK,t = leakage, tonnes CO$_2$-e yr^{-1} in year t

The tCERs will be calculated using equation (28) in the revised approved methodology AR-AM0001/version 02.

C.6. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored:		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	**Uncertainty level of data (High/Medium/Low)**	**Explain QA/QC procedures planned for these data, or why such procedures are not necessary.**
3.1.1.06 Plot location	*low*	*Random plot verification using GPS to ensure the consistent measuring and monitoring of the carbon stock change over time*
3.1.1.07 Tree species	*low*	*Random Verification over the project area to ensure the area of each tree species is correctly measured*
3.1.1.08 Age of plantation	*low*	*Random Verification over the project area to ensure the area in terms of plantation age is correctly measured*
3.1.1.09 Number of trees	*low*	*Random plot verification*
3.1.1.10 Diameter at breast height (DBH)	*low*	*Random plot verification*
3.1.1.12 Tree height	*low*	*Random plot verification*
3.1.1.14 standing volume	*low*	*All equations used to calculate this data shall be verified*
3.1.1.15 Wood density	*low*	*Data that divert significantly from IPCC default value shall be verified*
3.1.1.16 Biomass expansion factor (BEF)	*low*	*Data that divert significantly from IPCC default value shall be verified*

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3.1.1.17 Carbon fraction	*low*	*Data that divert significantly from IPCC default value shall be verified*
3.1.1.18 Root-shoot ratio	*low*	*Data that divert significantly from IPCC default value shall be verified*
3.1.2.09 Direct N2O emission of N input	*low*	*Data that divert significantly from IPCC default value shall be verified*
4.1.01 Number of each vehicle type used	*low*	*Project record shall be available and verified*
4.1.02 Emission factors for road transportation	*low*	*Data that divert significantly from IPCC default value shall be verified*
4.1.03 Kilometres travelled by vehicles	*low*	*Project record shall be available and verified*

C.7. Please describe the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity:

The proposed A/R CDM project activity will be implemented under the following operational and management structure:

● The provincial and county Project Management Offices (PMOs) that have been established under the umbrella GIFDCP will be responsible for coordinating the project participants, providing technical services, including arranging training to the planting entities and farmers/communities involved, supervising the implementation of the proposed A/R CDM project activity, as well as organizing a technical support panel (TSP) to carry out the monitoring of the project implementation performance and impacts, including measuring and monitoring of the actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity. The relevant information and data will be documented and archived in the PMOs and project entities in both electronic and paper copy.

● The Guangxi Forestry Inventory and Planning Institute, will take the lead for measuring and monitoring of the actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity. They will closely work with Cangwu and Huanjiang county PMOs and the project entities by providing technical guidance on the monitoring work, jointly carry out the field measurement and necessary survey, as well as the data collection and analysis. The project entities will take care of the requested routine measurement, data collection and documentation filing according to the project monitoring plan.

● The Chinese Academy of Forestry will provide technical consultation and training in the measuring and monitoring of the actual GHG removals by sinks and leakage generated by the proposed A/R CDM project activity to provincial and county technicians, as well as the project entity staff. They will also verify field data and data entry and analysis as well as be responsible for drafting the monitoring report.

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C.8. Name of person/entity determining the <u>monitoring methodology</u>:

Name of persons/entity determining the baseline

- Institute of Forest Ecology and Environment, the Chinese Academy of Forestry

  ➢ Dr. Xiaoquan Zhang, <u>xiaoquan@forestry.ac.cn</u>

- Joanneum Research, Austria

  ➢ Dr. Bernhard Schlamadinger, <u>bernhard.schlamadinger@joanneum.at</u>

- Guangxi Forestry Inventory and Design, P.R.China

  ➢ Ms. Zhuping Mo, <u>mzp1968@163.com</u>

- World Bank reviewers

  ➢ Ms Jin Liu, <u>Jliu@worldbank.org</u>

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

SECTION D. Estimation of <u>net anthropogenic GHG removals by sinks:</u>

D.1. Estimate of the <u>actual net GHG removals by sinks:</u>

The estimates of the actual net GHG removals by sinks include the direct N_2O emissions caused by N input, decrease in carbon stock due to loss of pre-existing non-tree vegetation and the carbon stock change in aboveground and belowground biomass of living trees (see section C.3.1.3 and Section III.5 of the revised approved methodology AR-AM0001/version 02 applied).

Local growth curves are used to estimate the biomass stock change achieved by the proposed A/R CDM project activity. These curves were derived from Chinese forestry inventories data that have been carried out every five years since the 1970s. Growth data (standing volume per hectare) are converted into biomass via wood density and Biomass Expansion Factors (BEF) and root-shoot ratio (Table C-1) by using equations (6) and (9) described in Section II.5 of the revised approved methodology AR-AM0001/version 02. These parameters are from LULUCF GHG inventory in China's initial national communications.

Since the planting will be carried out in two age cohorts from 2006 to 2007, carbon sequestration for each species planted in different years was calculated separately, and was added up at the end.

N_2O induced by N input is estimated by equation (23)-(25) in section II.7 of the revised approved methodology AR-AM0001/version 02 using the default values of GPG 2000 and 1996 IPCC Guideline. The synthetic nitrogen fertilizer is applied to eucalyptus plantation with 75 gN, 30gN and 40gN per tree respectively at the first, second and third year of the establishment or regeneration of the plantation.

The actual net GHG removals by sinks is that the carbon stock change in above- and below-ground biomass minus the increase in N_2O emission of nitrogen application. The carbon stock in biomass of existing non-tree vegetation is assumed to be 5 tC ha^{-1} based on default standing biomass of grassland in GPG LULUCF[24] and is deducted from the carbon stock in the first year of the crediting period. Detail data over 30-year-crediting period are listed in Table D-1 below.

Table D-1 Estimate of actual net GHG removals by sinks [25]

Year No	Year	Cumulative carbon stock change (tCO$_2$)		Annual GHG emission (tCO$_2$-e yr^{-1})	Cumulative GHG emission (tCO$_2$-e)	Annual actual net GHG removals (tCO$_2$-e yr^{-1})	Cumulative actual net GHG removals (tCO$_2$-e)
		Above-ground biomass	Below-ground biomass				
1	2006	-24,934	-15,276	-437	-437	-40,647	-40,647
2	2007	18,494	-4,022	-252	-688	54,430	13,783
3	2008	64,612	7,982	-264	-952	57,858	71,642
4	2009	110,238	19,926	-41	-993	57,530	129,171
5	2010	159,105	32,858	0	-993	61,799	190,970
6	2011	216,241	48,004	0	-993	72,281	263,251
7	2012	277,519	64,000	0	-993	77,275	340,526

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[24] Refers to table 3.4.2 and 3.4.3 in GPG LULUCF

[25] Notes: minus sign indicates the source while plus indicates the sink.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

8	2013	333,734	78,131	0	-993	70,345	410,872
9	2014	310,180	71,838	-57	-1,050	-29,904	380,968
10	2015	303,050	71,348	-126	-1,176	-7,746	373,221
11	2016	298,113	71,523	-217	-1,393	-4,978	368,243
12	2017	375,795	92,250	-160	-1,553	98,249	466,493
13	2018	438,262	108,185	-91	-1,644	78,310	544,803
14	2019	471,587	114,662	0	-1,644	39,802	584,605
15	2020	492,464	117,362	0	-1,644	23,577	608,181
16	2021	550,902	133,268	0	-1,644	74,345	682,526
17	2022	499,288	119,859	-57	-1,701	-65,080	617,446
18	2023	432,422	102,717	-126	-1,827	-84,133	533,313
19	2024	359,582	83,136	-217	-2,044	-92,639	440,674
20	2025	395,331	90,537	-160	-2,204	42,991	483,665
21	2026	421,019	94,769	-91	-2,295	29,828	513,493
22	2027	485,293	112,457	0	-2,295	81,962	595,455
23	2028	546,792	129,564	0	-2,295	78,605	674,061
24	2029	603,039	145,239	0	-2,295	71,922	745,983
25	2030	584,768	141,276	-57	-2,352	-22,291	723,692
26	2031	525,173	124,788	-126	-2,478	-76,207	647,484
27	2032	462,397	106,821	-217	-2,694	-80,961	566,523
28	2033	524,464	123,860	-160	-2,854	78,947	645,470
29	2034	585,122	140,651	-91	-2,946	77,357	722,827
30	2035	641,035	156,136	0	-2,946	71,398	794,225

D.2. Estimated baseline net GHG removals by sinks:

As elaborated in section B, under the baseline scenario, the carbon stock change in aboveground and belowground biomass on lands without growing trees is conservatively set to zero. Only the projected biomass growth of existing trees on lands with a few growing trees is included in the baseline.

There are 35 ha of lands with 40 growing trees per hectare in average, a mean DBH of 2.89 cm and mean height of 3.42 m. The main species are *L. formosana, Elaeocarpus decipiens* and *Albizzia julibrissin* with the age around 6 years. The carbon stock changes in above- and below-ground biomass of the existing trees are estimated using the parameters in Table C-1 above, equations (6)-(9) in section II.5 of the revised approved methodology AR-AM0001/version 02 and local-derived growth curve of broadleaf trees (to be conservative, the curve for fertile sites is used), and, this represents the baseline net GHG removals by sinks (seed Annex 3 for details).

Table D-2 Estimates of baseline net GHG removals by sinks

Year No.	Year	Baseline net GHG removals by sinks (t CO_2 yr^{-1})			Cumulative Baseline net GHG removals by sinks (t CO_2)		
		Above-ground biomass	Below-ground biomass	total	Above-ground biomass	Below-ground biomass	total
1	2006	6.1	1.7	7.8	6.1	1.7	7.8
2	2007	6.7	1.9	8.7	12.8	3.6	16.5
3	2008	7.4	2.1	9.5	20.2	5.7	25.9

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

4	2009	8.0	2.3	10.2	28.2	8.0	36.2
5	2010	8.6	2.4	11.0	36.8	10.4	47.2
6	2011	9.2	2.6	11.7	45.9	13.0	58.9
7	2012	9.7	2.7	12.5	55.6	15.7	71.4
8	2013	10.3	2.9	13.2	65.9	18.6	84.5
9	2014	10.8	3.1	13.9	76.7	21.7	98.4
10	2015	11.3	3.2	14.5	88.0	24.9	112.9
11	2016	11.8	3.4	15.2	99.9	28.3	128.1
12	2017	12.4	3.5	15.9	112.2	31.8	144.0
13	2018	12.9	3.6	16.5	125.1	35.4	160.5
14	2019	13.3	3.8	17.1	138.4	39.2	177.6
15	2020	13.8	3.9	17.7	152.3	43.1	195.4
16	2021	14.3	4.0	18.4	166.6	47.1	213.7
17	2022	14.8	4.2	19.0	181.4	51.3	232.7
18	2023	15.2	4.3	19.6	196.6	55.6	252.2
19	2024	15.7	4.4	20.2	212.3	60.1	272.4
20	2025	16.2	4.6	20.7	228.5	64.7	293.1
21	2026	16.6	4.7	21.3	245.1	69.4	314.4
22	2027	17.1	4.8	21.9	262.1	74.2	336.3
23	2028	17.5	5.0	22.4	279.6	79.1	358.8
24	2029	17.9	5.1	23.0	297.6	84.2	381.8
25	2030	18.4	5.2	23.6	315.9	89.4	405.3
26	2031	18.8	5.3	24.1	334.7	94.7	429.4
27	2032	19.2	5.4	24.6	353.9	100.2	454.1
28	2033	19.6	5.6	25.2	373.5	105.7	479.3
29	2034	20.0	5.7	25.7	393.6	111.4	505.0
30	2035	20.5	5.8	26.2	414.0	117.2	531.2

D.3. Estimated leakage:

Labors used for the proposed A/R CDM project activity are from local villages, hence transportation for labors is not needed. Except for eucalyptus of which seedlings will be cultured off-sites, all seedlings will be bred on-site and will be transported to the project sites by manpower. There is also a need for transporting timber from the 7th year onward and resin from 16th to 20th year. A medium size vehicle that uses diesel is usually used in the project area. Based on the amount of eucalyptus seedlings needed for reforestation, the expected output of timber and resin as well as the needed amount of fertilizers, the leakage caused by vehicle uses is estimated using equation (27) and (28) in Section II.8 of the revised approved methodology AR-AM0001/version 02 applied. The emission factor is 2.6353 kg CO_2 litre^{-1} for diesel for mid-size vehicle that is commonly used in the area (from China's national initial national communication). The expected leakage is 232 t CO_2-e by the year 2012, and 19,852 t CO_2-e by the end of the crediting period (Table D-3 below).

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Table D-3 Estimates of leakage

Year No.	Year	Annual Leakage (t CO_2-e yr^{-1})	Cumulative Leakage (t CO_2-e)
1	2006	-140	-140
2	2007	-27	-168
3	2008	-38	-206
4	2009	-6	-212
5	2010	0	-212
6	2011	0	-212
7	2012	-21	-232
8	2013	-83	-315
9	2014	-1,376	-1,691
10	2015	-1,304	-2,995
11	2016	-1,317	-4,312
12	2017	-23	-4,335
13	2018	-105	-4,440
14	2019	-367	-4,808
15	2020	-367	-5,175
16	2021	-46	-5,221
17	2022	-2,903	-8,124
18	2023	-2,903	-11,027
19	2024	-3,009	-14,036
20	2025	-547	-14,583
21	2026	-491	-15,074
22	2027	0	-15,074
23	2028	0	-15,074
24	2029	0	-15,074
25	2030	-1,386	-16,460
26	2031	-1,671	-18,131
27	2032	-1,685	-19,816
28	2033	-23	-19,839
29	2034	-13	-19,852
30	2035	0	-19,852

D.4. The sum of D.1 minus D.2 minus D.3 representing the net anthropogenic GHG removals by sinks of the proposed A/R CDM project activity:

The sum of D.1 minus D.2 plus D3 indicates that the net anthropogenic GHG removals by sinks as a result of the proposed A/R CDM project activity is anticipated to be over 770,000 tones of CO_2 equivalent during the crediting period (between 1 April 2006 and 31 March 2036) per the Table D-4 and Fig. D-1 (by the year 2012: 340,223 t CO_2-e, by the year 2017: 462,013 t CO_2-e).

Table D-4 Estimates of net anthropogenic GHG removals by sinks

Year No	Year	Annual net anthropogenic GHG	Cumulative net anthropogenic GHG

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		removals by sinks (t CO_2-e yr^{-1})	removals by sinks (t CO_2-e)
1	2006	-40,795	-40,795
2	2007	54,394	13,599
3	2008	57,811	71,410
4	2009	57,514	128,924
5	2010	61,788	190,711
6	2011	72,269	262,981
7	2012	77,242	340,223
8	2013	70,250	410,472
9	2014	-31,294	379,178
10	2015	-9,065	370,113
11	2016	-6,310	363,803
12	2017	98,210	462,013
13	2018	78,189	540,202
14	2019	39,417	579,619
15	2020	23,192	602,811
16	2021	74,280	677,091
17	2022	-68,002	609,089
18	2023	-87,056	522,033
19	2024	-95,668	426,366
20	2025	42,423	468,789
21	2026	29,316	498,105
22	2027	81,940	580,045
23	2028	78,583	658,628
24	2029	71,899	730,527
25	2030	-23,701	706,826
26	2031	-77,903	628,924
27	2032	-82,670	546,254
28	2033	78,899	625,152
29	2034	77,319	702,471
30	2035	71,371	773,842

Fig.D-1 Ex ante estimated net anthropogenic GHG removals by sinks

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D.5.	**Table providing values obtained when applying formulae above:**

See Table D-5.

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Table D-5

Years	Estimation of baseline net GHG removals by sinks (tones of CO2 e yr^{-1})	Estimation of actual net GHG removals by sinks (tones of CO2 e yr^{-1})	Estimation of leakage (tonnes of CO2 e yr^{-1})	Estimation of net anthropogenic GHG removals by sinks (tones of CO2 e yr^{-1})
A	B	C	D	E=C+D-B
2006	7.8	-40,647	-140	-40,795
2007	8.7	54,430	-27	54,394
2008	9.5	57,858	-38	57,811
2009	10.2	57,530	-6	57,514
2010	11.0	61,799	0	61,788
2011	11.7	72,281	0	72,269
2012	12.5	77,275	-21	77,242
2013	13.2	70,345	-83	70,250
2014	13.9	-29,904	-1,376	-31,294
2015	14.5	-7,746	-1,304	-9,065
2016	15.2	-4,978	-1,317	-6,310
2017	15.9	98,249	-23	98,210
2018	16.5	78,310	-105	78,189
2019	17.1	39,802	-367	39,417
2020	17.7	23,577	-367	23,192
2021	18.4	74,345	-46	74,280
2022	19.0	-65,080	-2,903	-68,002
2023	19.6	-84,133	-2,903	-87,056
2024	20.2	-92,639	-3,009	-95,668
2025	20.7	42,991	-547	42,423
2026	21.3	29,828	-491	29,316
2027	21.9	81,962	0	81,940
2028	22.4	78,605	0	78,583
2029	23.0	71,922	0	71,899
2030	23.6	-22,291	-1,386	-23,701
2031	24.1	-76,207	-1,671	-77,903
2032	24.6	-80,961	-1,685	-82,670
2033	25.2	78,947	-23	78,899
2034	25.7	77,357	-13	77,319
2035	26.2	71,398	0	71,371
Total (tones of CO2 e)	531.2	794,225	-19,852	773,842

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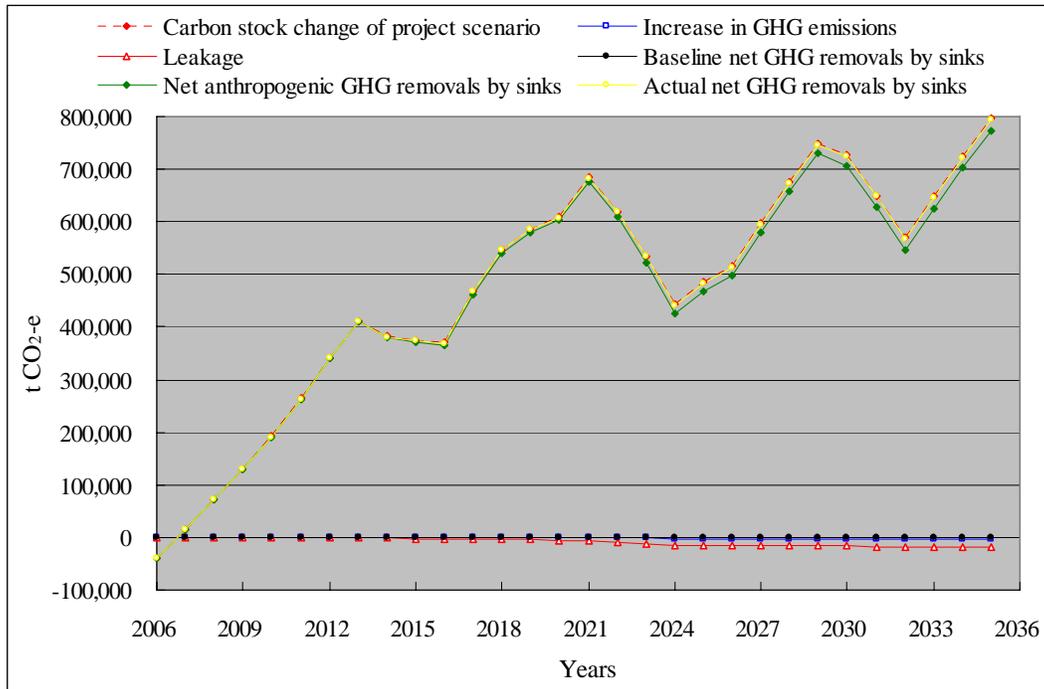**FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02**

SECTION E. Environmental impacts of the proposed <u>A/R CDM project activity</u>:

E.1. Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the <u>project boundary</u> of the proposed <u>A/R CDM project activity</u>:

Through establishing 4000 ha of multiple-use forests in the watershed along the Pear River Basin that suffers from severe soil erosion and on the lands close and between nature reserves, the proposed A/R CDM project activity will increase the forest coverage in project towns/townships by 1.34% in average, and provide the following additional environmental benefits.

● **Enhancing biodiversity and ecosystem integrity:**

As elaborated in Section A.4.1.5, the project areas are important habitats for rare and endangered wildlife, making the proposed A/R CDM project activity significant positive biodiversity benefits:

➢ Providing corridors to enhance the viability of wildlife populations through facilitation of gene flow.

➢ Restoring connectivity between forests will increase the protected forests scope to improve the status of currently unprotected species.

➢ *P. massoniana* and *Quercus* sp. will provide additional fruits/seeds and leaves as food for the primates and other wildlife.

➢ Providing firewood to the communities, thus reducing the pressure of firewood collection on the nature reserves and strengthening the biodiversity conservation.

➢ Providing habitats for the movement of some types of birds, mammals and snakes.

➢ Improving the habitats of migratory birds through habitat restoration. For instance, the project sites in Huanjiang County, through which birds migrate, will serve as roosting/staging sites once the trees have grown.

➢ Generating increased income to local communities from the proposed A/R CDM project activity. This will reduce their tendency to degrade biodiversity through practices such as poaching, forest fires and illegal logging and NTFP collection in the nature reserve. These activities are key threats to the nature reserve management.

● **Controlling soil erosion**

As elaborated in Annex 3, due to the consecutive deforestation, subsequent over-use of fuelwood and frequent fire, most lands are severely degraded and suffer from serious soil erosions that directly threaten the cropland nearby and the streams and rivers below. If the current situation remains as it has been, the lands will degrade further and the soil erosion will become more and more severely. The forest restoration will improve soil and water erosion control in this area.

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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

- **Improving environmental services**

    - Regulating hydrological flows which in turn alleviates drought risk and reduces flooding risks;

    - Building and improving nutrient cycling within soil; and

    - Contributing to local climate stabilization.

- **Building incentives to people to invest in sustainable land use**

- **Improving watershed management and contributing to the outside of the project boundary and the ecosystem improvement along the Pearl River, through demonstration and extension of the project experience to other areas.**

Risk analysis and countermeasures:

- **Species:** To reduce or avoid the potential negative impacts by planting pure eucalyptus, mitigation measures will be taken, including limiting the land size of eucalyptus plantation, low planting density, appropriate fertilizer application, mixed planting sites with local species in mosaic layout and keeping the original vegetation in valleys.

- **Fire and pest risk:** The burning in neighboring cropland is subjected to bring fire threat to the forests. This can be alleviated through technical and awareness training to local farmers/communities, strengthening patrolling and monitoring, as well as building the fire-break belt. Furthermore, a mixed reforestation arrangements will be adopted to reduce fire and pest risks.

- **Site preparation:** The site preparation will disturb the vegetation and soil in the planting sites. The main technical measures to be employed in mitigating the impacts are to plant the trees with low density (1250-2500 trees per hectare), limited hole site preparation (40 cm X 50 cm in diameter or 0.2 m^2), retaining the existing vegetation as mush as possible (see section A.4.8). As a result, the surface area disturbed by site preparation is estimated to account for 2-5% of the total land surface. The hole will be dug along the landform contour in triangle form to reduce the soil loss. Therefore the site and soil preparation will have minor negative impacts on original soil and vegetation.

- **Fertilization:** In the proposed A/R CDM project activity, only eucalyptus will be applied with compound or organic fertilizer. As the eucalyptus will be planted in separate small patches, fertilizer will be applied within the small planting hole rather than overall dispersing, so that the potential risk of the fertilization application can be reduced to minimum.

- **Pesticide:** improper pesticide application would be harmful to natural environment, including polluting soil, water and air conditions, as well as the habitat of the wildlife. However under the proposed A/R CDM activity, the environmental friendly measures will be adapted such as mixed species arrangement, seed and seedling quarantine, as well as an integrated pest management (IPM) approach, especially biological measures to control pests and diseases will be adopted. Therefore, the pesticide application will be limited. The pest management plan has been developed for the umbrella GIFDCP and it will be used to guide the pest prevention and control, as well as the pesticide application in case the pest and disease will be occurred during the project implementation.

None of these risks and/or negative impacts are considered to be significant.

E.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

No significant negative impacts have been identified due to the environmental-friendly techniques adopted in the proposed A/R CDM project activity, e.g., avoidance of slash and burn and overall tillage, proper choice of tree species and their spatial arrangement, etc. Even though, environmental impact assessment has been undertaken and the environment management plan has been developed under the umbrella GIFDCP to guide and monitor this project implementation. These documents are available to the DOE for inspection.

E.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section E.2. above:

No significant negative impacts have been identified. However, environmental monitoring plan and remedial measures for any risks will be implemented and monitored under the integrated umbrella GIFDCP.

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

SECTION F. Socio-economic impacts of the proposed A/R CDM project activity:

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F.1. Documentation on the analysis of the socio-economic impacts, including impacts outside the project boundary of the proposed A/R CDM project activity:

Agriculture is the main source of income for local communities in the project area. However, due to severe soil erosion, agricultural production has suffered very much from flood, drought and other disasters. Food productivity is very low and the mean annual income per capita in the project areas is only US$ 145, and even under US$ 100 in some remote villages. Income in Cangwu is relatively higher although there is less land per capita, but the income varies larger among different villages within the project boundary.

To maximize the socio-economic benefit, the reforestation design was prepared with a participatory approach. PRA methods were adopted in interviewing and consulting with farmer households in the project areas to understand the local farmers/communities' preferences, wishes and concerns, so that the proposed A/R CDM project activity would better respond to their desires for livelihood development (see section G below). Farmers decided the final contractual production arrangements as they liked, such as the individual farmer voluntary groups and shareholding arrangement between local farmers/communities and forest farms/companies (see section G2.1). The local farmers will participate in the reforestation activities such as site preparation, planting, weeding, thinning, harvesting, etc. and earning direct benefits during the crediting period. It is expected that 27 villages of 10 towns/townships will benefit from the proposed project. The main socio-economic benefits of the project include:

(1)   Income generation: About 20,000 local farmers of 5,000 households will benefit from the project. The total income is estimated at US$ 21.1 million within the crediting period, including about US$ 15.6 million from employment, US$ 3.5 million from sales of wood and non-wood products and US$ 2.0 million from sales of CERs. The mean net annual income per capita will be increased by US$ 34 or by 23.8% compared to the year 2004 (table F-2 below). The income generation is especially significant and important for ethnic minorities in Huangjiang County where the proposed A/R CDM project activity will increase the mean net annual income per capita by about 200% compared to the year 2004 (table F-2 below). The added income per capita of local farmers/communities in Cangwu County is relatively less due to relatively higher population.

(2)   Creating employment: The proposed A/R CDM project activity will create about 5 million person-days of temporary employment opportunities from planting, weeding, harvesting and resin collection. It will also create 40 long-term job positions during the crediting period (Table F-3). Most employment opportunities will be taken by the local farmers/communities involved in the proposed A/R CDM project activity and beyond (whose lands do not fall within the project boundary). Project areas in Huanjiang County are dominated by ethnic minorities, thus the employment opportunities will be available to local ethnic minority groups (Table F-4).

(3)   Sustainable fuelwood supply: The local communities depend on fuelwood for living to a certain extent, especially in Cangwu County, where most of the fuelwood they collected currently are shrub and herbaceous plants. The proposed A/R CDM activity will provide more sustainable fuel sources for local farmers. In addition, local governments are demonstrating and extending bio-gas energy by providing subsidy for local farmers who builds bio-gas system, and this will alleviate the pressure of fuelwood collection on planted forests.

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PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Table F-1 Socio-economic Profiles of Project Areas

County	Town/ township	Village	Planting area (ha)	Number of village group	Number of house-hold	Population	Number of labour force	People employed outside	Minority population	Cropland area (ha)	Food production per capita (kg)	Mean annual net income per capita (US$)	Annual fuelwood Consumption per capita (kg)
Cangwu	Dapo	Shengzhou	83	21	892	3,695	2,424	221		185	335	266	350
		Xinglong	123	16	910	3,170	2,040	420		182	307	309	300
		Dayan	87	6	185	767	443	90		41	287	241	400
		sub-total	293	43	1,987	7,632	4,907	731		408	319	281	334
	Xingdi	Dianchun	335	27	765	3,294	1,840	832		131	230	74	180
		Dongxin	102	30	900	4,368	2,100	1,304		162	200	76	180
		Xunchun	51	24	904	4,311	1,905	813		93	185	72	206
		Dachun	78	14	450	2,506	1,612	405		140	205	75	180
		Datong	294	17	854	3,814	706	308		107	210	63	160
		sub-total	861	112	3,873	18,293	8,163	3,662		634	205	72	182
	Longxu	Enyi	48	12	685	2,748	1,523	252		293	597	304	200
		Daen	90	21	783	3,225	2,079	484		299	479	292	172
		sub-total	138	33	1,468	5,973	3,602	736		592	533	298	185
	Shatou	Chantian	398	24	439	1,879	1,022	204		53	255	177	650
		Shichuan	210	17	214	1,062	484	98		27	260	190	850
		Shentang	100	34	795	4,010	1,712	413		102	250	204	730
		sub-total	708	75	1,448	6,951	3,218	715		183	253	194	727
	County Total		2000	263	8,776	38,849	19,890	5,844		1,816	286	170	310
Huanjiang	Mulun	Leyi	82	8	207	821	390	42	810	70	290	115	192
	Minglun	Baixiang	23	635	2,370	1,120	138	2,290	166	23	240	102	200
		Cuishan	20	324	1,692	805	77	1,630	120	20	235	100	190
		sub-total	43	959	4,062	1,925	215	3,920	287	43	238	101	196

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Shangchao	Beishan	84	28	699	2,742	1,326	165	2,693	180	280	117	160
Xunle	Taiping	58	23	635	2,370	1,120	138	2,290	166	240	102	200
	Shangang	280	20	324	1,692	805	77	1,630	120	235	100	190
	sub-total	338	43	959	4,062	1,925	215	3,920	287	238	101	195
Chuanshan	Hedun	123	30	613	2,960	1,382	210	2,730	239	290	133	180
Longyan	Chaoge	455	27	570	2,300	1,120	178	1,867	153	210	89	210
	Dake	211	31	680	2,560	1,050	180	2,352	93	225	102	200
	Huangzhong	171	21	335	1,632	786	103	1,428	52	230	98	220
	Chenghuang	32	7	230	1,028	530	86	985	40	240	104	195
	Jiuwei	62	9	180	740	316	58	653	87	250	96	210
	Longyan	41	22	670	2,852	1,376	209	2,510	124	420	126	190
	sub-total	971	117	2,665	11,112	5,178	814	9,795	549	276	105	203
County total		2000	257	5,948	25,255	11,951	1,717	23,239	3,808	266	108	193
Project total		4000	520	14724	64104	31841	7561	23239	5623	278	145	264

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Table F-2 Income generated by project activities

County	Township	Number of villages that benefit	Number of Beneficiaries	Net income within lifetime of the project (US$ `000)				Added annual net income (10³US$)	Added annual net income per capita (US$)	Net income per capita in 2004 (US$)	Income increase compared to 2004 (%)
				Labours	Wood & non-wood product	CERs	Total				
Cangwu	Dapo	3	3,600	1,037	281	121	1,439	48	13	281	4.7
	Xindi	5	8,563	2,881	1,249	341	4,470	149	17	72	24.2
	Longxu	2	1,530	428	106	59	592	20	13	298	4.3
	Shatou	3	4,520	1,703	540	234	2,477	83	18	194	9.4
	Sub-total	**13**	**18,213**	**6,049**	**2,175**	**754**	**8,978**	**299**	**16**	**170**	**9.7**
Huanjiang	Mulun	1	102	619	36	17	672	22	220	115	191.1
	Chuanshan	1	296	249	258	41	548	18	62	133	46.2
	Longyan	6	760	4,362	36	214	4,539	151	199	105	190.4
	Xunle	2	156	2,065	167	81	2,312	77	494	94	525.8
	Minglun	3	283	1,923	703	126	2,752	92	324	101	320.2
	Shangchao	1	196	314	159	31	504	17	86	117	73.0
	sub-total	**14**	**1,793**	**9,532**	**1,287**	**509**	**11,328**	**378**	**211**	**105**	**199.7**
	Total	27	20,006	15,581	3,462	1,264	20,306	677	34	142	23.8

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Table F-3 Employment created by project activities

County	Town/ township	Number of villages that benefit	Number of Beneficiary	Temporary (days)					Long-term position
				Planting	Weeding & tending	Harves-ting	Resin collecting	Total	
Cangwu	Dapo	3	3,600	17,113	105,482	135,108	80,049	337,751	8
	Xindi	5	8,563	50,793	199,053	556,518	132,313	938,678	6
	Longxu	2	1,530	8,055	35,983	50,495	44,953	139,486	2
	Shatou	3	4,520	55,746	104,021	162,031	229,446	551,243	4
	Sub-total	13	18,213	131,707	442,656	897,054	486,000	1,957,416	20
Huanjiang	Mulun	1	102	7,273	19,071	156,319	17,712	200,375	2
	Chuanshan	1	296	8,162	14,594	51,944	5,886	80,587	2
	Longyan	6	760	90,944	129,265	1,078,880	112,482	1,411,571	5
	Xunle	2	156	28,362	45,400	533,859	60,480	668,101	3
	Minglun	3	283	28,071	118,364	445,555	30,240	622,231	9
	Shangchao	1	196	5,025	22,758	73,854	0	101,637	
	sub-total	14	1,793	167,836	349,453	2,340,412	226,800	3,084,501	20
	Total	27	20,006	299,543	792,110	3,237,466	712,800	5,041,918	40

Table F-4 Number of beneficiaries for different town/townships

and ethnic minorities created by project activities

Town/ township	Number of villages that benefit	Number of Beneficiaries	Number of beneficiaries for ethnic minorities						
			Zhuang	Maonan	Yao	Mao	Buyi	Shui	total
Mulun	1	102	76	26					102
Chuanshan	1	296	232	8					240
Longyan	6	760	620	15	7				642
Xunle	2	156	86			70			156
Minglun	3	283	270	6	7				283
Shangchao	1	196	196						196
Total	14	1,793	1,480	55	14	70			1,619

(4) **Strengthening social cohesion:** As indicated earlier, individual farmer households/communities are too weak to successfully manipulate the chain from investment, production to market especially for the timber and non-wood forest products which will take a much longer period than food production. In addition, the lack of organizational instruments also prevents them from overcoming technological barriers. Overall the proposed A/R CDM project activity will entail close interaction between individuals, communities, companies and government, with intensified communication among them and supporting networks for social and productive services, especially for the ethnic minorities.

(5) **Technical training and demonstration:** Interview with local communities indicated that

local farmers/communities are usually short of access to quality seed sources and lack skills for producing high quality seedlings and for successful tree planting, as well as for preventing planted trees from being subject to fire, pest and disease attack. This is one of the important barriers of local communities in planting trees on their lands. In the proposed A/R CDM project activity, the local forestry agencies as well as companies/farms will organize the training for local communities to assist them in understanding and evaluating the issues of hosting the proposed A/R CDM project activity, both on-site and off-site such as seed and seedling selection, nursery management, site preparation, planting models and Integrated Pest Management.

Potential socio-economic risks and countermeasures

(1)   Cultural Resources

There are no cultural relics and/or cultural reserve that have been identified in the project area, and consequently, no damage to non-replicable cultural property will occur under the proposed A/R CDM project activity. Meanwhile, the project does not involve any sites for local social gatherings or other spiritual activities, thus the project activities will not impact the normal local gatherings and religious activities. It is found that the local farmers have the traditional custom of ground burial. According to some ethnic minority groups' beliefs (such as the Buyi), they view the mountains and trees around their lineage/family

Burial ground on some sites

cemeteries or burial grounds as "geomantic/Fengshui mountain" and "sacred trees" that are untouchable. The project activities of reforestation are fully consistent with local people's beliefs to protect such mountains and forests from environmental degradation.
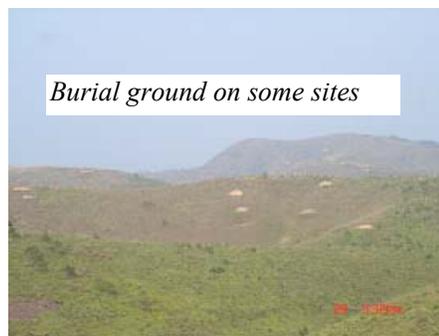
(2)   Ethnic Minority Groups

There are 6 ethnic minority groups involved in the proposed A/R CDM project activities. According to the social assessment report done by the social assessment team, there are equal rights for the ethnic minority groups to access to development opportunities. In view of the various situations of the ethnic groups, a Multi-Ethnic Minority Development Plan (EMDP) has been developed to address all the concerns and issues specific to these groups for the umbrella GIFDCP, which will apply to the project to indicate the ways for the proposed A/R CDM project activity to be designed compatibly with ethnic minorities' cultures.

(3)   Economic risk

The potential economic risks will be poor management of the plantations established under the project such as lack of pest and fire control, which would contribute to project failure and farmers' loss. This risk will be mitigated by providing technical assistance and training to farmers and communities, by local forestry agencies, forestry research and design institutions, as well as by the extension network of the forestry sector. Forestry farms/companies are experienced in reforestation and watershed management, which will also provide the technical assistance to the farmers/communities.

F.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socioeconomic impact assessment, in

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

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accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

None of the potential risks is considered to be significant. Even though, socio-economic impact assessment has been undertaken under the umbrella GIFDCP. The Social Assessment Report, with the Action Plan has been developed to assess the project social impacts to the local communities and provide guidance of taking into the social consideration to the project design.

F.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section F.2 above:

Although there is no significant negative socio-economic impact, the monitoring plan including the mitigation measures to address any potential risks will be implemented under the umbrella GIFDCP.

SECTION G. Stakeholders' comments:
>>

G.1. Brief description of how comments by local stakeholders have been invited and compiled:

Comments by stakeholders have been invited using PRA methodology. One village from each of town/township has been randomly selected for the PRA. Ten villages were investigated, specifically the PRA include following processes:

(1) **Distribution of leaflet.** A project leaflet has been prepared with the brief introduction of the project objective, main activities, benefits and potential risk, as well as the modalities and procedures of the CDM A/R project. The leaflet was distributed to the proposed project communities before the PRA process, and was explained during the PRA process.

(2) **Seminar of farmers' representatives**. To get comprehensive information of the historic and current situation and existing problems in local communities, as well as to understand the need and desire of local farmers, a meeting of farmer representatives was held in each selected village. Participants include village headers, farmer representatives, chief town/township management staff responsible for agriculture and forestry, and staff of local forestry stations. Favorable tree species were also discussed and listed by scoring in the meeting.

(3) **Questionnaire**. Questionnaire forms were developed and distributed among different stakeholders, including households (10-15 households randomly selected from each selected villages), villages, town/township governments, forest farms, local forest stations and forestry bureau and nature reserves. The questionnaire forms were collected and analyzed to understand the local socio-economic profiles, land use, land tenure, income and sources, land management ways, awareness, technical know-how, favorable tree species, technical and financial barriers, need and desire of farmers in the ways to participating in the proposed A/R CDM project activity from relevant stakeholders.

(4) **Interview.** 35 persons in each town/township, village, private company and forest farm involved in the proposed A/R CDM project activity and nature reserves nearby were interviewed. 10-15 households were randomly selected from each selected village were also interviewed using semi-structured approach.

G.2. Summary of the comments received:

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Comments from local farmers, villages and companies/farms, etc. are summarized as follow:

1. Primary stakeholders

(1)   Farmers/communities

Local farmers/communities expresses their strong interests to participate in the proposed A/R CDM project activity because they thought that through participating in the proposed A/R CDM project activity they can obtain the following benefits:

- ✓ Employment chance. They do not have to find jobs far away from hometown, which make it possible to look after their cropland at the same time.

- ✓ Income increase from selling wood and non-wood products and CER trade in addition to direct products.

- ✓ Greening their barren lands that can improve local environment, shelter cropland and reduce drought, flood and other natural disasters.

- ✓ Learning good practice on tree planting and forest management from technical training.

PRA survey indicates that 117 out of 121 farmer households randomly chosen from 10 villages willing to participate the proposed A/R CDM project activity, accounting for 97%. Among all of households interviewed, more than 90% households prefer to cooperate with companies or forest farms by contractual arrangements. The survey showed the proposed production arrangements: the household offer lands as equity in return for a stake in net profits of about 20-30%, or like to lease their lands to companies or forest farm and then earn income through labor input and land lease; In addition, the households will receive the cash payment by planting entities. Local forest farms or companies invest in planting, provide technical inputs, manage the plantation stands and undertake related risks, taking 70-80% of stake shares in return for a profit; and less than 10% of households surveyed prefer to finance and manage the proposed A/R CDM project activity and obtain the full profits from the project.

During the PRA process, the scoring assessment on tree species also indicates that local farmers/communities prefer tree species that grow fast and have good market, such as Cangwu County: *Eucalyptus* sp, Oak, *Pinus massoniana*, bamboo, *Schima superba*, *Cunninghamia lanceolata*, Huanjiang County: *C. lanceolata*, *P.massoniana*, *Liquidambar formosana*, *Eucalyptus* sp., and bamboo.

(2)   Companies/Farms

All of the four private forest companies/farms that mainly focus on afforestation/reforestation and forest management in Cangwu and Huangjiang County are very interested in participating in the proposed A/R CDM project activity. They would like to invest in the reforestation on the economically unattractive lands because:

➢ They can share part of income from sale of CERs that have no market risk, in addition to wood and non-wood forest products;

➢ The commercial loan and government counterpart funding can alleviate their financial pressure from pre-investment, without the proposed A/R CDM project activity such loans is difficult to obtain in the context of remote degraded lands and co-funding would be unavailable.

➢ Without the proposed A/R CDM project activity, they would be unwilling to invest in the afforestation or reforestation on the degraded barren lands due to the unacceptably low economic revenues.

With regard to the financing arrangements, all of the four companies/farms prefer to rent lands from local farmers/communities and pay labor costs in addition to land lease costs. However, they would also accept the share holder arrangement as the project promoted.

2. Secondary stakeholders

(1) Local forestry departments: Forestry Bureaus and forestry stations of both project counties view that the proposed A/R CDM project activity will increase forest resources, improve the local environment and increase income of local farmers/communities, as well as demonstrate best practice of watershed management to other watershed areas in the Pearl River Basin. They would provide technical training and consultation to farmers/communities and planting entities, and supervise the implementation of the proposed A/R CDM project activity.

(2) Local Governments: County and township/town governments in Huangjiang and Cangwu Counties consider that the proposed A/R CDM project activity can improve local economy and alleviate local poverty especially for the ethnic minorities, and at the same time benefit to globally climate change mitigation and biodiversity conservation as well as improve watershed management. Therefore, the proposed A/R CDM project activity would have great impacts as if technical best practices developed by the proposed A/R CDM project activity are extended to neighbouring areas or local communities that do not involve in the project.

(3) Nature Reserves: The lands to be reforested in Huanjiang County are directly linked to or fall between two national reserves. Both nature reserves believe that the proposed A/R CDM project activity will benefit to the biodiversity conservation by enhancing forest connectivity and reducing pressure on the nature resources by providing sustainable fuelwood to the local communities. The reserves also propose to use native species as much as possible, establish mixed forests and avoid a large area of pure plantation.

(4) Downstream communities: Communities at the downstream areas believe that the proposed A/R CDM project activity will improve water quality downstream by reducing soil erosion and provide a good model for watershed management. However, they also advise to avoid slash and burn site preparation and overall ploughing soil preparation which result in severe soil erosion, and to carefully select and use fertilizers and pesticides.

G.3. Report on how due account was taken of any comments received:

The comments received from the PRA survey were fully taken into account as follows:

➢ Participation of local farmers/communities and companies/farms is on a voluntarily basis.

➢ Choice of financing arrangements was based on the preference of local farmers/communities. However, to maximize benefits of local farmers/communities, under the contractual arrangements, the project promotes joint partnerships where small farmers would not simply rent their land, but be full partners sharing in the profits of the venture, in which local farmers/communities can get 40% of revenue from forest products and 60% of revenue from CER. This benefit sharing of the farmers/communities is higher than the ratio that local farmers/communities expected.

➢ Preferences of local farmers/communities were taken into account in the selection of tree species;

➢ Most of tree species used are native to local, and a mixed species arrangements will be used. For eucalyptus, small patches will be planted rather than a large area of pure eucalyptus plantation;

➢ Compound and/or organic fertilizers will be applied to eucalyptus plantations through small holes rather than overall dispersion;

➢ Use of chemical pesticides will be limited. Rather, disease and pest will be controlled by mixed tree species arrangement and other biological measures;

➢ Slash and burn site preparation and overall ploughing for soil preparation will not be used.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED A/R CDM PROJECT ACTIVITY.

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FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funding will be used from Official Development Assistance.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Annex 3

BASELINE INFORMATION

1. Historical land use/cover changes

Collected information demonstrates that the lands to be reforested were forested lands in the 1950s. However these forests were destroyed gradually primarily due to three policy-induced events from the 1950s to the 1980s. The first event occurred due to the Great Leap Forward campaign and the Steel and Iron campaign in the late 1950s. A large area of forests was harvested for steel and iron production. The second event was during the Cultural Revolution campaign from 1966 to 1976. During that period many of the remaining secondary forests were cultivated as cropland. The third event occurred during the late 1970s and early 1980s due to an unsuccessful land tenure reform in which lands including remaining secondary forests were allocated to individual household or villager groups who immediately harvested all forests allocated to them without any measurement for regeneration because they did not have confidence in the land tenure reformation. Due to these deforestation events, most land had become non-forest lands by the mid 1980s. Nevertheless, human intervention did not halt on these lands, but continued as fuelwood over-exploitation and over-grazing. Frequent fires that are usually caused by prescribed burning of croplands have been another significant threat to the lands in the last decade. Due to the consecutive human interventions, the lands have severely degraded and serious soil erosion continues. Although grazing does not exist now, fuel wood collection and fire events still occur widely within the project boundary. Some villages even harvest grasses and

Burnt lands caused by prescribed burning in cropland

shrubs remaining on the lands for fuel because of the unavailability of other fuelwood sources. In the future, under baseline conditions, the lands will continue to degrade and soil erosion will accelerate, resulting in the continuous decrease of the carbon stocks both in living biomass and soils.

Interviews with local farmers also indicated that many barriers for them to plant trees on these degraded lands, i.e., low land productivity, unaffordable front investment, difficult to get loans for planting trees on the remote degraded lands, lack and inaccessibility of reforestation techniques on degraded lands, and the inability of efficient marketing of forest products.

2. Site classification and quality assessment

The site quality information of lands to be planted has been collected and investigated (see elaboration in section B.2). Processes for land survey, information collection and site classification were as follows:

➢ Field study tours on each piece of land to inspect the existing vegetation, soil condition and erosion status.

➢ Interview with local farmers on land use/cover history, important events that have impacted the land use/cover, and current human interventions (grazing, collecting of fuel and medicinal plants, etc).

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

➢ Sampling surveys on representative lands including

    ✓ Crown cover and mean height for herbaceous vegetation, shrubs and trees;

    ✓ Soil type, soil depth, and soil sampling and analyzing.

Based on the collected information, in combination with landform, climate and soil types, the lands to be planted have been classified into 7 categories that are described below.

Category I (Locations: Lands in Satou Town of Cangwu County)

➢ Existing vegetation: Herbaceous cover 92%-94% with height 0.2-1.2m; shrub cover 4-5% with height 1.0-2.0m; **without growing trees**; fuel collection and frequent fire

➢ Landform: Elevation 300-700m, slope gradient 25-35 degrees

➢ Soils: red earth developed from sandstone, soil depth 70-110 cm, humus layer 2-5cm, soil erosion modulus 2500-5000 t km^{-2} yr^{-1}

Table annex 3-1 Soil conditions of site category I

No	Soil layer	Depth (cm)	Soil organic matter (g. $100g^{-1}$)	Total N (g. $100g^{-1}$)	Total P (g. $100g^{-1}$)	Total K (g. $100g^{-1}$)
1	A	0-16	7.254	0.273	0.055	2.005
	AB	16-25	2.682	0.135	0.060	2.289
	B	25-100	0.987	0.065	0.064	3.070
	Mean		2.142	0.105	0.062	2.829
2	A	0-11	6.648	0.248	0.081	1.322
	AB	11-28	3.176	0.140	0.071	1.567
	B	28-105	1.243	0.080	0.066	1.753
	Mean		2.166	0.109	0.069	1.674
3	A	0-14	6.623	0.253	0.060	2.423
	AB	14-26	3.549	0.169	0.058	2.886

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

B	26-71	1.821	0.138	0.064	3.087
Mean		2.701	0.158	0.063	2.970
Mean *		2.043(9.4%)	0.117(15.6%)	0.065(5.0%)	2.530(29.7%)

* data in parentheses indicate the standard deviation in percentage of the mean.

Category II (Locations: Chantian Village and Shichuan village in Satou Town of Cangwu County)

➤ Existing vegetation: Herbaceous cover 95%-98% with height 0.2-1.5m; shrub cover 3-7% with height 1.0-1.5m; **with growing trees**; fuel collection and frequent fire

➤ Landform: Elevation 300-700m, slope gradient 25-35 degrees

➤ Soils: red earth developed from sandstone, soil depth 70-110 cm, humus layer 2-5cm, soil erosion modulus 2500-5000 t km^{-2} yr^{-1}

Table annex 3-2 Soil conditions of site category II

No	Soil layer	Depth (cm)	Soil organic matter (g. $100g^{-1}$)	Total N (g. $100g^{-1}$)	Total P (g. $100g^{-1}$)	Total K (g. $100g^{-1}$)
1	A	0-11	6.648	0.248	0.081	1.322
	AB	11-28	3.176	0.140	0.071	1.567
	B	28-105	1.243	0.080	0.066	1.753
	Mean		2.166	0.109	0.069	1.674
2	A	0-16	5.853	0.198	0.055	1.489
	AB	16-29	2.871	0.122	0.045	1.312
	B	29-110	1.122	0.102	0.047	1.357
	Mean		2.106	0.120	0.048	1.372
mean			2.136(2.0%)	0.114(7.0%)	0.058(24.9%)	1.523(14.0%)

The site conditions of category I and category II are similar. The only different is that there are growing trees in category II.

Category III (Locations: Lands in Xindi Town and Dapo Town in Cangwu County)

➤ Existing vegetation: Herbaceous cover 70-90% with height 0.2-1.2m; shrub cover 3-7% with height 0.5-2.0m; **without growing trees;** fuel collection and frequent fire

➤ Landform: Elevation below 300m, hilly land, slope gradient 15-25 degrees

➤ Soils: crimson soil developed from granite, humus layer 2-5 cm, soil erosion modulus 2500-5000 t km^{-2} yr^{-1}.

Table annex 3-3 Soil conditions of site category III

No	Soil layer	Depth (cm)	Soil organic matter (g. $100g^{-1}$)	Total N (g. $100g^{-1}$)	Total P (g. $100g^{-1}$)	Total K (g. $100g^{-1}$)
1	A	0-17	6.139	0.189	0.045	1.732
	AB	17-47	2.828	0.108	0.022	1.849

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

	B	47-102	0.969	0.055	0.015	2.061
	Mean		2.406	0.094	0.022	1.941
2	A	0-12	5.875	0.221	0.107	1.102
	AB	12-47	1.164	0.079	0.121	1.335
	B	47-100	1.053	0.066	0.132	1.416
	Mean		1.670	0.089	0.125	1.350
3	A	0-10	4.692	0.157	0.032	2.002
	AB	10-30	2.387	0.105	0.029	2.149
	B	30-110	1.698	0.086	0.01	2.452
	Mean		2.135	0.097	0.016	2.346
4	A	0-10	4.646	0.142	0.038	4.347
	AB	10-60	0.937	0.057	0.018	4.049
	B	60-110	0.855	0.046	0.015	3.724
	Mean		1.283	0.062	0.019	3.981
5	A	0-10	6.985	0.199	0.057	0.477
	AB	10-43	1.975	0.073	0.043	0.52
	B	43-93	1.228	0.055	0.05	0.758
	Mean		2.050	0.075	0.048	0.651
Mean			1.909(22.9%)	0.083(17.3%)	0.046(99.6%)	2.054(61.0%)

Category IV (Locations: Lands in Chuanshan, Shangchao, Minglun, Xunle Town/Township in Huanjiang County)

➢ Existing vegetation: Herbaceous cover 98% and height 0.5-0.8m; shrub cover 10% and height 0.7m; **without growing trees;** fuel collection and frequent fire

➢ Landform: Elevation below 300-700m, hilly land and low mountains, slope gradient 20-30 degrees

➢ Soils: yellow red soil developed from sand stone, soil erosion modulus 2500-5000 t km^{-2} yr^{-1}

Table annex 3-4 Soil conditions of site category IV

No	Soil layer	Depth (cm)	Soil organic matter (g. $100g^{-1}$)	Total N (g. $100g^{-1}$)	Total P (g. $100g^{-1}$)	Total K (g. $100g^{-1}$)
1	A	0-19	6.08	0.227	0.062	2.127
	AB	19-29	1.96	0.125	0.057	2.237
	B	29-123	1.68	0.107	0.057	2.335
	Mean		2.544	0.132	0.058	2.286
2	A	0-15	5.78	0.231	0.067	2.123
	AB	15-31	2.05	0.130	0.053	1.973
	B	31-102	1.33	0.098	0.048	1.876

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Mean	2.113	0.123	0.052	1.929
mean	2.328(13.1%)	0.127(4.7%)	0.055(8.0%)	2.107(12.1%)

Category V (Locations: Lands in Longyan, Minglun Town/Township in Huanjiang County)

➢ Existing vegetation: Herbaceous cover 90% with height 1.2m; shrub cover <10% with height 0.3-0.7m; **without growing trees; fuel collection and frequent fire**

➢ Landform: Elevation below 700-1100m, low mountains, slope gradient 25-35 degrees

➢ Soils: yellow red soil developed from sand stone, lower fertility, soil erosion modulus 2500-5000 t km^{-2} yr^{-1}

Table annex 3-5 Soil conditions of site category V

No	Soil layer	Depth (cm)	Soil organic matter (g. 100g^{-1})	Total N (g. 100g^{-1})	Total P (g. 100g^{-1})	Total K (g. 100g^{-1})
1	A	0-15	4.16	0.239	0.037	2.565
	AB	15-30	1.58	0.112	0.029	2.250
	B	30-107	0.78	0.059	0.029	2.341
	Mean		1.407	0.094	0.030	2.361
2	A	0-15	5.70	0.254	0.069	2.536
	AB					
	B	15-107	1.87	0.108	0.055	2.673
	Mean		2.445	0.130	0.057	2.652
mean			1.926(38.1%)	0.112(22.7%)	0.044(43.6%)	2.507(8.2%)

Category VI (Locations: Lands in Xunle, Minglun and Longyan Town/Township in Huanjiang County)

➢ Existing vegetation: Herbaceous cover 90-95% with height 1.0m; shrub cover <5% with height 0.5-0.7m; **without growing trees;** fuel collection and frequent fire

➢ Landform: Elevation below 700-1100m, low mountains, slope gradient 25-35 degrees

➢ Soils: yellow red soil developed from sand stone, lower fertility, soil erosion modulus 5000-8000 t km^{-2} yr^{-1}

Table annex 3-6 Soil conditions of site category VI

No	Soil layer	Depth (cm)	Soil organic matter (g. 100g^{-1})	Total N (g. 100g^{-1})	Total P (g. 100g^{-1})	Total K (g. 100g^{-1})
1	A	0-12	3.20	0.237	0.019	0.807
	AB	12-28	0.82	0.102	0.013	1.238
	B	28-53	0.99	0.133	0.017	2.454
	Mean		1.439	0.147	0.016	1.714
2	A	0-12	1.13	0.093	0.021	0.364

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

	AB	12-39	0.55	0.068	0.029	1.432
	B	39-82	0.57	0.069	0.036	2.018
	Mean		0.866	0.106	0.022	1.812
3	A	0-6	4.43	0.218	0.033	1.065
	AB					
	B	6-67	1.97	0.108	0.033	2.128
	Mean		2.190	0.118	0.033	2.033
mean			1.498(44.3%)	0.124(17.2%)	0.024(36.3%)	1.853(8.8%)

Category VII (Locations: Lands in Mulun, Chuanshan, Xunle and Minglun Town/Township in Huanjiang County)

➢ Existing vegetation: Herbaceous cover 98% with height 1.0 m; shrub cover 3-7% with height 0.3-0.7m; **without growing trees;** fuel collection and frequent fire

➢ Landform: Elevation below 700 m, karst hilly land, slope gradient 20-30 degrees

➢ Soils: brown limestone soil developed from limestone, lower fertility, soil erosion modulus 5000-8000 t km^{-2} yr^{-1}

Table annex 3-7 Soil conditions of site category VII

No	Soil layer	Depth (cm)	Soil organic matter (g. $100g^{-1}$)	Total N (g. $100g^{-1}$)	Total P (g. $100g^{-1}$)	Total K (g. $100g^{-1}$)
1	A	0-18	4.48	0.302	0.033	0.468
	AB	18-53	1.65	0.059	0.014	0.763
	B	53-105	0.83	0.074	0.015	1.538
	Mean		1.774	0.110	0.018	1.074
2	A	0-7	4.21	0.222	0.023	0.346
	AB	7-38	1.18	0.053	0.015	0.587
	B	38-103	0.84	0.060	0.019	1.219
	Mean		1.181	0.069	0.018	0.962
mean			1.478(28.4%)	0.089(32.1%)	0.018(0.6%)	1.018(7.8%)

3. Ex ante stratification

Based on the site investigation and assessment, the project area is categorized into 7 strata. Each category is a stratum (table annex 3-8). Strata I-III are located in Canwu County and strata IV-VII are located in Huangjiang County.
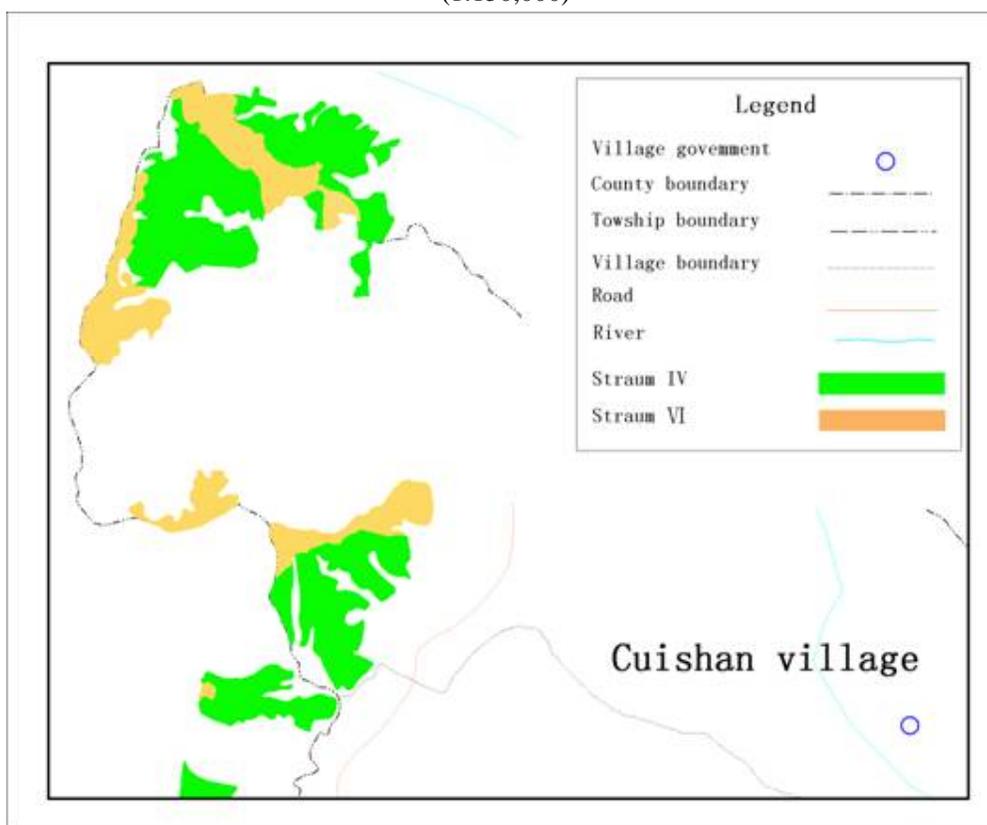
Table annex 3-8 Lists of strata

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

Stratum	Growing trees	Soil type	elevation	Soil erosion modules t km^{-2} yr^{-1}
I	No	Read earth from sandstone	lower	2500-5000
II	Yes	Red earth from sandstone	lower	2500-5000
III	No	Crimson from granite	lower	2500-5000
IV	No	Yellow-red from sandstone	lower	2500-5000
V	No	Yellow-red from sandstone	higher	2500-5000
VI	No	Yellow-red from sandstone	higher	5000-8000
VII	No	Brown limestone from limestone	lower	5000-8000

The stratification has been built into a GIS that has been used to produce stratification Maps. An example of a stratification map in Cuishan Village of Huanjiang County is shown in Fig Annex 3-1.

Fig Annex 3-1 Stratification map in Cuishan Village of Huanjiang County
(1:150,000)

4. Estimation of the baseline net GHG removals by sinks

For lands with growing trees, stratum II, with a total area of 35 ha, the carbon stock change is estimated by projecting the continuous growth rate of existing trees. The existing trees are dominated by *Liquidambar formosana* with age around 6 year, mean DBH of 2.89cm and mean height 3.42m. The mean number of trees per hectare is 40 trees.ha^{-1}. The crown area for 1 tree at maturity is estimated about 25 m^2, and 40 trees gives 1000 m^2, equivalent to 10% of crown cover, which is below the threshold of

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

20% for defining as a forest. Based on the growth curve of *Liquidambar formosana* derived from local data:

$$V = 126.27034 \cdot (1 - e^{0.0913281 \cdot A)})^{1.274443}$$

Where

A = age of trees, yr

V = standing volume, m^3 tree^{-1}

Using stock change method by following equations to estimate the carbon stock in the above- and below-ground biomass of the existing trees.

$$CStock_{AB} = 44.05 \cdot 50 \cdot V \cdot D \cdot BEF \cdot CF \cdot 44/12$$

$$CStock_{BB} = CStock_{AB} \cdot R$$

Where

V = Standing volume, m^3 tree^{-1}

A = age of trees, yr

$CStock_{AB}$ = the carbon stock in aboveground biomass of existing trees, t CO_2

$CStock_{BB}$ = the carbon stock in belowground biomass of existing trees, t CO_2

35 = area of lands with growing trees, ha

40 = number of trees per hectare, trees.ha^{-1}

D = 0.443, wood density, t d.m m^{-3}, see table C-1

BEF = 2.31, the biomass expansion factor, dimensionless. BEF for single trees is likely bigger than forests and there is no BEF for single trees. To make our estimation conservative, we assumed that BEF for single trees is 50% bigger than forests, i.e, BEF for single trees = 1.54 X 1.5 = 2.31. 1.54 is from table C-1.

R = 0.283, the root-shoot ratio, dimensionless, see table C-1

CF = 0.5, the carbon fraction

$44/12$ = ration of molecular weights of carbon and CO_2, dimensionless

The estimated baseline GHG removals by sinks are the sum of the carbon stock change in above- and below-ground biomass. Detail information is listed in Table annex 3-9 below.

Table annex 3-9 Estimates of baseline carbon stock changes

Year No.	Year	Carbon stock change in aboveground biomass (t CO_2 yr^{-1})	Carbon stock change in belowground biomass (t CO_2 yr^{-1})	Baseline net GHG removals by sinks (t CO_2 yr^{-1})	Cumulative Baseline net GHG removals by sinks	
					t CO_2	t CO_2 ha^{-1}
1	2006	6.1	1.7	7.8	7.8	0.3
2	2007	6.7	1.9	8.7	16.5	0.5
3	2008	7.4	2.1	9.5	25.9	0.9
4	2009	8.0	2.3	10.2	36.2	1.2
5	2010	8.6	2.4	11.0	47.2	1.6
6	2011	9.2	2.6	11.7	58.9	2.0
7	2012	9.7	2.7	12.5	71.4	2.4
8	2013	10.3	2.9	13.2	84.5	2.8
9	2014	10.8	3.1	13.9	98.4	3.3
10	2015	11.3	3.2	14.5	112.9	3.8
11	2016	11.8	3.4	15.2	128.1	4.3

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

12	2017	12.4	3.5	15.9	144.0	4.8
13	2018	12.9	3.6	16.5	160.5	5.3
14	2019	13.3	3.8	17.1	177.6	5.9
15	2020	13.8	3.9	17.7	195.4	6.5
16	2021	14.3	4.0	18.4	213.7	7.1
17	2022	14.8	4.2	19.0	232.7	7.8
18	2023	15.2	4.3	19.6	252.2	8.4
19	2024	15.7	4.4	20.2	272.4	9.1
20	2025	16.2	4.6	20.7	293.1	9.8
21	2026	16.6	4.7	21.3	314.4	10.5
22	2027	17.1	4.8	21.9	336.3	11.2
23	2028	17.5	5.0	22.4	358.8	12.0
24	2029	17.9	5.1	23.0	381.8	12.7
25	2030	18.4	5.2	23.6	405.3	13.5
26	2031	18.8	5.3	24.1	429.4	14.3
27	2032	19.2	5.4	24.6	454.1	15.1
28	2033	19.6	5.6	25.2	479.3	16.0
29	2034	20.0	5.7	25.7	505.0	16.8
30	2035	20.5	5.8	30.5	531.2	17.7

5. Uncertainty Assessment

The uncertainties in the estimation of the baseline net GHG removals by sinks come from the growth curve, BEF, wood density and root-shoot ratio. The growth curve is derived from local forestry inventory data with the expert judgement percentage uncertainty of 10% at 95% confidence level. The mean values and standard deviations of BEF, wood density and root-shoot ratio are listed in Table C-1, from which the percentage uncertainties for *Liquidambar formosana* at 95% confidence level have been estimated at 10.2%, 0.4% and 16.6% for BEF, wood density and root-shoot ratio, using equations as follows[26],

$$U_s(\%) = \frac{\frac{1}{2}\left(95\% \, ConfidenceIntervalWith\right)}{\mu} \cdot 100$$

$$= \frac{\frac{1}{2}(4\sigma)}{\mu} \cdot 100$$

Where

U_s = percentage uncertainty of each parameter, %

μ = mean value of each parameter (BEF, wood density, root-shoot ratio)

σ = standard error of each parameter (BEF, wood density, root-shoot ratio)

The uncertainties of the baseline net GHG removals by sinks in the above- and below-ground biomass pools are then estimated at 21.9%, using equation[27]

$$U_S = \sqrt{U_{BEF}^2 + U_D^2 + U_{GC}^2 + U_R^2}$$

Where

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[26] Box 5.2.1 in GPG LULUCF

[27] Equation 5.2.1 in GPG LULUCF

U_S = percentage uncertainty of baseline net removal by sinks in above- and below-ground biomass carbon pools

U_{BEF} = percentage uncertainties associated with BEF

U_D = percentage uncertainties associated with wood density

U_R = percentage uncertainties associated with root-shoot ratio

U_{GC} = percentage uncertainties associated with growth curve

Although this uncertainty is high in relative terms, it is low in absolute numbers (563 tCO2) over the 30 year crediting period. This number is low because it is associated with the growth of pre-existing trees, which only exist on a small share of the project area.

Annex 4

MONITORING PLAN

1. Monitoring of the baseline net GHG removals

The carbon stock changes in the baseline scenario do not need to be monitored.

2. Monitoring the overall performance of the proposed A/R CDM project activity

a) monitoring actual project boundary;

b) Monitoring the areas and quality of forest establishment to ensure the technical design described in section A is well-implemented;

c) Monitoring of forest management.

The specific indicators to be monitored listed in section C.3 will be applied.

3. Monitoring the actual net GHG removals by sinks data

a) Stratification

The strata built in the Annex 3 have been further divided into sub-strata in terms of the year to be planted. The planting activity will last two years starting in 2006. Therefore each stratum is divided into 2 substrata. As an example, a strata and sub-strata map in Cuishan Village of Huanjiang County is shown in fig. Annex 4-1 below.

Fig.Annex 4-1 Stratification Map in Cuishan Village of Huanjiang County (1:150,000)
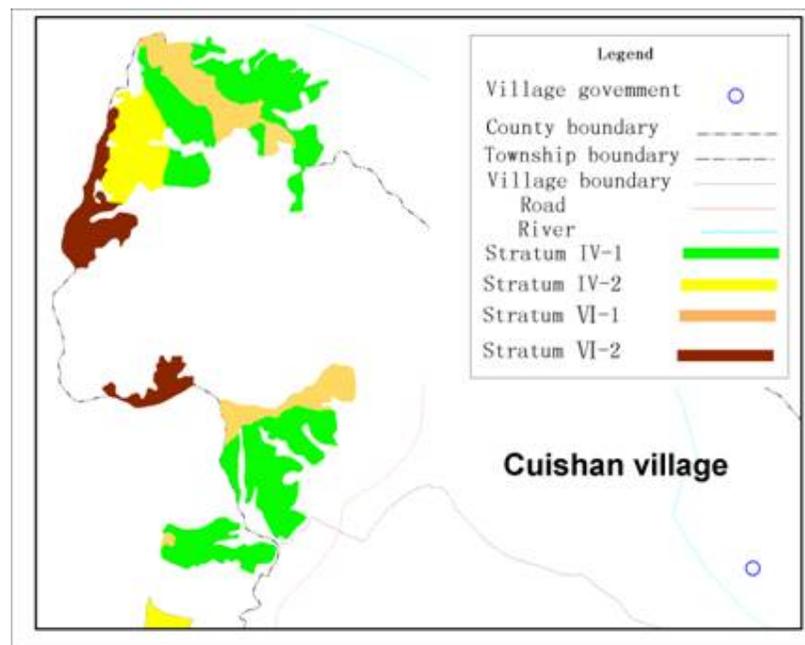
However, post stratification will be conducted after the first monitoring event to address the possible

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

changes of project boundary and planting year in comparison to the project design, and to address whether the change in carbon stocks is more or less variable than expected, taking into account data from the monitoring of the proposed A/R CDM project activity and the variation in carbon stock change for each stratum and substratum after the first monitoring event. Strata or substrata will be grouped into one stratum or substratum if they have similar carbon stock, carbon stock change and spatial variation.

b) Sampling Frame

- **Determining sample size**

Equations (1)-(2) in section C have been used to calculate the number of plots for each stratum and sub-stratum (table Annex 4-1). The standard deviation of each stratum/sub-stratum (s_h) has been calculated from the mean standard deviation of soil organic matter and nitrogen content in Annex 3. The allowable error is the 5% of the weighted mean carbon stock in living biomass per plot at harvest age of each stratum/sub-stratum. The t value is determined based on the 95% confidence level. The cost to establish a plot in each stratum/sub-stratum is assumed to be same. To ensure statistically independence for each stratum/substratum, minimum 3 plots are set for each species within each substratum.

However, it is possible to reasonably modify the sample size after the first monitoring event based on the variation of the carbon stock changes.

Table Annex 4-1 Number of monitoring plots for each stratum and sub-stratum

Stratum-Substratum ID	Area (ha)	Number of plots
I-1	211.0	6
I-2	454.3	9
II-1	9.0	6
II-2	33.0	6
III-1	540.0	17
III-2	752.7	10
IV-1	350.0	3
IV-2	150.0	3
V-2	450.0	15
VI-1	408.1	12
VI-2	560.0	17
VII-1	81.9	6
total	**4000.0**	**110**

- **Locating sampling plots**

The permanent sample plots will be located systematically with a random start, using GPS. The size of plots is 400 m^2 (20m X 20m).

c) Monitoring frequency

The planting activity will be conducted from 2006 to 2007. *P. massoniana and C. lanceolata* will not be harvested during the crediting period, but *L. formosana* and *S. superba* will be harvested at age 17, eucalyptus around age 10 and oak at age 7. To avoid the coincidence with peaks in carbon stocks, the first monitoring will be conducted in the year 2009 followed by a monitoring event in 2012, with a subsequent monitoring interval of 5 years, i.e., in 2017, 2022, 2027, 2032, and 2037 respectively. Verification will be

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

conducted in 2017, 2022, 2027, 2032, and 2037 (table Annex 4-2).

Table Annex 4-2 Monitoring times versus harvest time

Year No	Year	Monitoring	Verification	Harvesting			
				P. massoniana and C. lanceolata	*L. formosana and S. superba*	eucalyptus	Oak
1	2006						
2	2007						
3	2008						
4	2009	X					
5	2010						
6	2011						
7	2012	X	X				X
8	2013						X
9	2014					X	X
10	2015					X	
11	2016					X	
12	2017	X	X				
13	2018						X
14	2019						X
15	2020						X
16	2021						
17	2022	X	X		X	X	
18	2023				X	X	
19	2024				X	X	X
20	2025						X
21	2026						X
22	2027	X	X				
23	2028						
24	2029						
25	2030						X
26	2031					X	X
27	2032	X	X			X	X
28	2033					X	
29	2034						
30	2035						
31	2036						
32	2037	X					

d) Measuring and estimating carbon stock changes over time

Specific steps, parameters and formula in section C.3.1.3.1 will be adhered to.

e) Monitoring GHG emissions by sources as the results of the A/R CDM project activity

Specific steps, parameters and formula in section C.3.1.3.2 will be adhered to.

4. Monitoring the leakage

Specific steps, parameters and formula in section C.4.1 will be adhered to.

5. Monitoring the social economy of stakeholders

Although no significant negative social-economic impacts have been identified in section F, under the

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

umbrella of GIFDCP, the output and selling price of wood and non-wood products including income from CER will be recorded instantaneously and the actual income of respective stakeholders (farmers/communities and forestry farms/companies) at different financing arrangements will be monitored and documented. Special attention will be paid to income of ethnic minorities. The income changes of the households and communities would also be monitored and assessed.

6. Monitoring environmental impacts

Although no significant negative environmental impacts have been identified as described in section E, The impacts on biodiversity and hydrological aspects will be monitored under the umbrella of the GIFDCP.

The biodiversity will be monitored by permanent sampling plots. Five subplots (2m×2m) within each plot will be randomly selected, and plant species and its richness within each subplot will be investigated. Any visible wildlife will be recorded.

To monitor the water and soil erosion of the planted sites, a paired catchments will be built respectively on planted land and control lands, and runoff from the catchments will be measured. This monitoring will be conducted under the larger umbrella Guangxi Integrated Forestry Development and Conservation Project (GIFDCP).

7. Quality Assurance and Quality Control (QA/QC)

To ensure the net anthropogenic GHG removals by sinks to be measured and monitored precisely, credibly, verifiably and transparently, a quality assurance and quality control (QA/QC) procedure will be implemented,

a) Reliable field measurements

To ensure the reliable field measurements,

> ➢ Standard Operating Procedures (SOPs) for each step of the field measurements, including all detail phases of the field measurements and provisions for documentation for verification purposes, will be developed and adhered to over time.

> ➢ Training courses on the field data collection and data analyses will be held for persons involving in the field measurement work. The training courses should ensure that each field-team member is fully aware of all procedures and the importance of collecting data as accurately as possible. To achieve this, both classroom examination and field examination will be conducted, and only those that have passed the examination can join the team. Test plots will be established and used for the field examination in which all measurements of pertinent components and procedures will be examined.

> ➢ A document that shows that these steps have been followed will be presented as a part of the project documents. The document will list all names of the field team and the project leader will certify that the team is trained;

> ➢ Any new staff will be adequately trained.

b) Verification of field data collection

To verify that the plots have been installed and the measurements taken correctly, the following work would be undertaken:

> ➢ 20% of randomly selected plots will be re-measured by another team

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

> ➢ 10% of randomly selected plots will be re-measured by an independent qualified team.

> ➢ Key re-measurement elements include the location of plots, DBH and tree height of all trees present.

> ➢ The re-measurement data will be compared with the original measurement data. Any errors found will be corrected and recorded. Any errors discovered will be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error. If the difference between the re-measurement and original measurement is higher than 5%, the sample plot will be eliminated.

c) Verification of data entry and analysis

To minimize the possible errors in the process of data entry, the entry of both field data and laboratory data will be reviewed by an independent expert team and compared with independent data to ensure that the data are realistic. Communication between all personnel involved in measuring and analysing data will be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot should not be used in the analysis.

d) Data maintenance and archiving

Data archiving will take both electronic and paper forms, and copies of all data will be provided to each project participant. All electronic data and reports will also be copied on durable media such as CDs and copies of the CDs are stored in multiple locations. The archives include:

> ➢ Copies of all original field measurement data, laboratory data, data analysis spreadsheet;

> ➢ Estimates of the carbon stock changes in all pools and non-CO_2 GHG and corresponding calculation spreadsheets;

> ➢ GIS products;

> ➢ Copies of the measuring and monitoring reports.

8. Uncertainty assessment

The uncertainty for each species in each stratum can be estimated from re-measurement of randomly selected plots and/or from the measurement of replicate plots. Uncertainties will be estimated and expressed as half the 95% confidence interval width divided by the estimated value, i.e.[28],

$$U_s(\%) = \frac{\frac{1}{2}\left(95\% ConfidenceIntervalWith\right)}{\mu} \cdot 100$$

$$= \frac{\frac{1}{2}(4\sigma)}{\mu} \cdot 100$$

Where

U_s = percentage uncertainty of each species within sub-stratum, %
μ = mean value
σ = standard deviation

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[28] Box 5.2.1 in GPG LULUCF

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 02

The uncertainty of each sub-stratum is then combined using the following error propagation equations[29]:

$$U_c = \frac{\sqrt{(U_{s1} \cdot C_{s1})^2 + (U_{s2} \cdot C_{s2})^2 + \cdots + (U_{sn} \cdot C_{sn})^2}}{\left| C_{s1} + C_{s2} + \cdots + C_{sn} \right|}$$

Where

U_c = combined percentage uncertainty of sub-stratum, %
U_{si} = percentage uncertainty of species i in the sub-stratum, %
C_{si} = mean carbon stock of species i in the sub-stratum

The stratum and total percentage uncertainties are further combined in the same way as above.

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[29] Refers to equation 5.2.2 in GPG LULUCF

CDM Project Activity Registration
and Validation Report Form
(By submitting this form, designated operational entity confirms that the proposed CDM project activity meets all validation and registration requirements and thereby requests its registration)

UNFCCC

Section 1: Request for registration	
Name of the designated operational entity (DOE) submitting this form	TÜV SÜD Industrie Service GmbH
Title of the proposed CDM project activity (Section A.2 of the attached CDM-PDD) submitted for registration	Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin
Project participants (Name(s))	• Xinghuan Forestry Development Company Ltd., • The International Bank for Reconstruction and Development as a Trustee of the Bio Carbon Fund of the World Bank for Italy • The International Bank for Reconstruction and Development as a Trustee of the Bio Carbon Fund of the World Bank for Spain.
Sector in which project activity falls	Afforestation and Reforestation
Is the proposed project activity a small-scale activity?	Yes / <u>No</u> *(underline as applicable)*

Section 2: Validation report	
List of documents to be attached to this validation report (please check mark):	

X   The CDM-PDD of the project activity

X   An explanation by the submitting designated operational entity of how it has taken due account of comments on validation requirements received, in accordance with the CDM modalities and procedures, from Parties, stakeholders and UNFCCC accredited non-governmental organizations;

❑   The written approval of voluntary participation from the designated national authority of each Party involved, including confirmation by the host Party that the project activity assists it in achieving sustainable development:

    o   (Attach a list of all Parties involved and attach the approval (in alphabetical order))

X   Other documents, including any validation protocol used in the validation

    o   (comprehensive list of documents attached clearly referenced)

    o   List of persons interviewed by DOE validation team during the validation process

    o   Any other documents. Please specify.

X Information on when and how the above validation report is made publicly available.

❑   Banking information on the payment of the non-reimbursable registration fee

X A statement signed by all project participants stipulating the modalities of communicating with the Executive Board and the secretariat in particular with regard to instructions regarding allocations of CERs at issuance

Executive Summary and Introduction, including

- **Description of the proposed CDM project activity**
- **Scope of validation process (include all documentation that has been reviewed and name persons that have been interviewed as part of the validation, as applicable)**
- **DOE Validation team (list of all persons involved in the validation, describing functions assumed in the validation)**

The objective of the project activity is directed towards to project areas which are separated from each other:

1) Establishment of 2000ha of multi purpose forst in Huanjiang County of Guangxi.
2) Establishment of 2000ha of multi purpose forst in Cangwu County of Guangxi.

The validation scope is defined as an independent and objective review of the project design document, the project's baseline study and monitoring plan and other relevant documents. The information in these documents is reviewed against Kyoto Protocol requirements, UNFCCC rules and associated interpretations. TÜV SÜD has, based on the recommendations in the Validation and Verification Manual employed a risk-based approach in the validation, focusing on the identification of significant risks for project implementation and the generation of CERs.

All documentation that has been reviewed and all persons interviewed as part of the validation are listed in annex 2 of the validation report (Validation Report No.: 756176, rev. 02).

Studying the existing documentation belonging to this project, it was obvious that the competence and capability of the validation team has to cover at least the following aspects:

➢ Knowledge of Kyoto Protocol and the Marrakech Accords
➢ Environmental and Social Impact Assessment
➢ Skills in environmental auditing (ISO 14000, EMAS)
➢ Quality assurance
➢ Carbon sequestration by trees
➢ Monitoring concepts
➢ Political, economical and technical frame conditions in host country

According to these requirements TÜV SÜD has composed a project team in accordance with the appointment rules of the TÜV certification body "climate and energy":

Michael Rumberg is head of the division CDM/JI at TÜV SÜD Industrie Service GmbH. He holds a master degree in forest sciences. In his position he is responsible for the implementation of validation, verification and certifications processes for greenhouse gas mitigation projects in the context of the Kyoto Protocol. Before entering this company he worked as an expert for renewable energy, forestry, environmental issues, climate change and sustainability within the environmental branch of an insurance company. His competences are covering risk assessments, quality and environmental auditing (EMS auditor), baseline setting, monitoring and verification due to the requirements of the Kyoto Protocol.

Jimmy Zhou is deputy head of the TÜV Management Service department at Guangzhou offices of TUV Product Service Ltd. He is an environmental engineer. In his position he is responsible for the implementation of certification processes for quality and environmental management systems. He has received extensive training in CDM related issues and participated already in several CDM project assessments as a trainee auditor and local expert.

Hubertus Schmidtke is an expert for forest inventory design with respect to monitoring of carbon pools in afforestation and reforestation projects. He has received extensive training in CDM related issues and participated already in AR CDM project assessments as a trainee auditor and technical expert.

The audit team covers the above mentioned requirements as follows:

➢ Knowledge of Kyoto Protocol and the Marrakech Accords (RUMBERG)
➢ Environmental and Social Impact Assessment (RUMBERG /ZHOU)
➢ Skills in environmental auditing (RUMBERG / ZHOU)
➢ Quality assurance (RUMBERG / ZHOU)
➢ Carbon sequestration in trees (RUMBERG/SCHMIDTKE)
➢ Monitoring concepts (RUMBERG/SCHMIDTKE)
➢ Political, economical and technical frame conditions in host country (ZHOU)

In order to have an internal quality control of the project, a team of the following persons has been composed by the certification body "climate and energy":

➢ Werner Betzenbichler (head of certification body "climate and energy")
➢ Susan Bautista (lead auditor ISO 9001/41001, technical expert)

For further details please refer to the "Introduction" section of the validation report (Validation Report No 756176, rev. 02).

Description of methodology for carrying out validation

- **Review of CDM-PDD and additional documentation attached to it**
- **Assessment against CDM requirements (e.g. by use of a validation protocol)**
- **Report of findings by the DOE, e.g. by use of type of findings (e.g. corrective action requests, clarifications or observations). Please explain the way findings are "labelled" during validation.**
- **Include statements or assessments in the section "Conclusions, final comments and validation opinion" below.**

The validation consists of the following three phases:

o Desk review

o Follow up interviews

o Resolution of clarification and corrective action requests

The audit team has been provided with a final PDD in December 2005. It serves as the basis for the assessment presented herewith. Based on this documentation an extensive document review and a fact finding mission in form of an on-site audit has taken place. During that process, the client decided to revise the PDD according to the CARs and CRs indicated in the audit process. The revised final PDD was submitted in July 2006. The changes in the December-version are not considered to be significant with respect to the qualification of the project as a CDM project based on the two main objectives of the CDM to achieve a reduction of anthropogenic GHG emissions and to contribute to sustainable development. Hence no repetition of the public stakeholder process has taken place. After the accreditation of the DOE under the respective scope a revised PDD has been submitted referring to version 02 of the methodology which has been approved during the time the accreditation procedure was running.

In order to ensure transparency, a validation protocol was customised for the project, according to the Validation and Verification Manual. The protocol shows, in a transparent manner, criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;

- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The completed validation protocol is enclosed in Annex 1 to the validation report.

Findings established during validation can either be seen as a non fulfilment of validation criteria or where a risk to the fulfilment of the project objectives is identified. Such findings are termed Corrective Action request. The term "Clarification request" is used when the validation team has identified a need for further clarification.

The Corrective Action Requests and Clarification Requests raised by TÜV SÜD were resolved during communication between the client and TÜV SÜD. To guarantee the transparency of the validation process, the concerns raised and responses that have been given are summarised in chapter 3 of the validation report and documented in more detail in the validation protocol in annex 1 to the validation report. The validation of the project resulted in one outstanding issue, three Corrective Action Request and thirty two Clarification Requests.

For further details please refer to the "Methodology" section of the validation report (Validation No. 756176, rev. 02).

Explanation by the submitting designated operational entity of how it has taken due account of comments on validation requirements received, in accordance with the CDM modalities and procedures, from Parties, stakeholders and UNFCCC accredited non-governmental organizations;

- **Description of how and when the PDD was made publicly available**
- **Description of how comments were received and made publicly available**
- **Explanation of how due account has been taken of comments received**
- **Compilation of all comments received (Identify the submitter)**

The PDD has been made public by February 16, 2006 until April 1, 2006.

(Link:
http://cdm.unfccc.int/Projects/Validation/DB/KNGJ1V3IYZYVJKLSQLNHTZ02F9QCM4/view.html)

No stakeholder comments have been received.

Conclusions, final comments and validation opinion

- **Provide conclusions on each requirement under paragraph 37 of the CDM modalities and procedures, describing how these requirements have been meet. This shall include assessments and findings (e.g. corrective action requests, clarifications or observations) in relation to each requirement, including a confirmation that all issues raised have been addressed to the satisfaction of the DOE.**
- **Final comments and validation opinion**

TÜV SÜD has performed a validation of the "Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin" project in China. The validation was performed on the basis of UNFCCC criteria as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and subsequent decisions by the CDM Executive Board.

The review of the project design documentation and the subsequent follow-up interviews have provided TÜV SÜD with sufficient evidence to determine the fulfilment of stated criteria. In our opinion, the project does meet all relevant UNFCCC requirements for the CDM and all relevant host

country criteria. The project will hence be recommended by TÜV SÜD for registration with the UNFCCC.

By storage of carbon dioxide by trees, the project results in reductions of CO_2 emissions that are real, measurable and give long-term benefits to the mitigation of climate change. An analysis of the investment barriers demonstrates that the project activity was at the time, when it was planned and realized, not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.

Additionally the assessment team reviewed the estimation of the projected emission reductions. We can confirm that the indicated amount of emission reductions of 773 842 tonnes CO_{2e} over a crediting period of thirty years, resulting in a calculated annual average of 25 795 tonnes CO_{2e}, represent a reasonable estimation using the assumptions given by the project documents.

The validation is based on the information made available to us and the engagement conditions detailed in this report. The validation has been performed using a risk based approach as described above. Hence, TÜV SÜD can not be held liable by any party for decisions made or not made based on the validation opinion.

The DOE declares herewith that in undertaking the validation of this proposed CDM project activity it has no financial interest related to the proposed CDM project activity and that undertaking such a validation does not constitute a conflict of interest which is incompatible with the role of a DOE under the CDM.

By submitting this validation report, the DOE confirms that all validation requirements are met. Name of authorized officer signing for the DOE	Werner Betzenbichler
Date and signature for the DOE	July 25, 2006

Section below to be filled by UNFCCC secretariat		
Date when the form is received at UNFCCC secretariat		
Date at which the registration fee has been received		
Date at which registration shall be deemed final		
Date of request for review, if applicable		
Date and number of registration	Date	Number

Version 02 / November 2002

SAMPLE AS A COURTESY
VALID LETTER OF APPROVAL ATTACHED IN SPANISH

Written Approval for the project "Facilitating reforestation for Guangxi Watershed Management in Pearl River Basin" (version GIFDCP01)

The Government of Spain, acting through the Spain's Designated National Authority (*Interministerial Commission presided by General Secretary for Prevention of Pollution and Climate Change*), hereby declares that:

(i)   Spain ratified the Kyoto Protocol on 31/05/2002;

Spain participates voluntarily in the Clean Development Mechanism (CDM);

(iii)   in accordance with the guidance issued by the Executive Board contained in the CDM glossary of terms, Spain hereby approves and authorizes the voluntary participation of the International Bank for Reconstruction and Development as Trustee of the BioCarbon Fund ("**BioCF**")[1] as a project participant in the "Facilitating reforestation for Guangxi Watershed Management in Pearl River Basin" project activity (the "**Project Activity**");

Spain recognises that the International Bank for Reconstruction and Development, as Trustee for the BioCF, is the focal point for the Project Activity with respect to all communications with the Executive Board and the United Nations Framework Convention on Climate Change.

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[1] A carbon fund operated by the International Bank for Reconstruction and Development as Trustee and comprising the following fund participants: Agence Française de Développement; the Government of Canada; Idemitsu Kosan Co., Ltd.; the Government of the Republic of Italy; Japan Petroleum Exploration Co., Ltd.; the Japan Iron and Steel Federation; Eco-Carbone representing Lesly Investments Ltd.; the Government of Luxembourg; Okinawa Electric Power Company, Inc.; the Kingdom of Spain; Sumitomo Chemical Co., Ltd.; Sumitomo Joint Electric Power Co., Ltd.; Suntory; Tokyo Electric Power Co., Inc.

CORREO ELECTRONICO

sgpccc@mma.es

PLAZA SAN JUAN DE LA CRUZ S/N
28071 MADRID.
TEL.: 91 597 60 26 / 6313
FAX : 91 597 59 91

Done at the Spanish DNA, located at plaza de San Juan de la Cruz s/n, 28071, Madrid, on April the 20th 2006.

For the Spanish Designated National Authority

Arturo Gonzalo Aizpiri

General Secretary for Prevention of Pollution and Climate Change

2 4 NOV. 2005

To whom it may concern

VueT. N° 6888/RAS/2005

Object: Written Approval for "Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin, China" Project

Italy, acting through the Italian Designated National Authority (Italian Ministry for the Environment and Territory, Department for Environmental Research and Development), hereby declares that:

(i)   Italy ratified the Kyoto Protocol on 31 May 2002;

(ii)   Italy participates voluntarily in the Clean Development Mechanism;

(iii)   in accordance with the guidance on multilateral funds issued by the Executive Board contained in the CDM glossary of terms (specifically, the definition of "Approval by Parties involved"), Italy hereby approves and authorises the voluntary participation of the International Bank for Reconstruction and Development as Trustee of the BioCarbon Fund ("**BioCF**")[1] as a project participant in the China - Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin Project activity (the "**Project Activity**");

(iv)   Italy recognises that the International Bank for Reconstruction and Development, as Trustee for the BioCF, is the focal point for the Project Activity with respect to all communications with the Executive Board and the United Nations Framework Convention on Climate Change.

Done at Rome, on 24 Nov. 2005

For the Italian Ministry for the Environment and Territory, Dep. for Environmental Research and Development

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(Corrado Clini)

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[1] A carbon fund operated by the International Bank for Reconstruction and Development as Trustee and comprising the following fund participants: Agence Française de Développement; the Government of Canada; Idemitsu Kosan Co., Ltd.; the Government of the Republic of Italy; Japan Petroleum Exploration Co., Ltd.; the Japan Iron and Steel Federation; Eco-Carbone representing Lesly Investments Ltd.; the Government of Luxembourg; Okinawa Electric Power Company, Inc.; the Kingdom of Spain; Sumitomo Chemical Co., Ltd.; Sumitomo Joint Electric Power Co., Ltd.; Suntory; Tokyo Electric Power Co., Inc.