Brown, S. (Principal Investigator). 2002. Land Use and Forests, Carbon Monitoring, and Global Change. Cooperative Agreement between Winrock International and the EPA ID# CR 827293-01-0. Winrock International.

There are several key issues related to land-use and forestry (LUCF) projects that have been identified as requiring further work. One of the most challenging is developing without-project baselines for determining additionality of projects. A fundamental step in the development of any project to mitigate GHG emissions is determining the extent to which project activities are additional to "business as usual". The first step in establishing additionality is developing a credible without-project baseline scenario against which changes in carbon in the project area can be compared. One of the most uncertain components of LUCF carbon-offset projects is the development of such a without-project baseline; this is especially true for projecting future trends in deforestation and other land-use changes that would have occurred but for the project.

Three approaches for developing baselines were identified for predicting the change in the use of the land. All three approaches are basically designed to extrapolate past trends in the use of lands into the future. All of the approaches use models (simple to complex), which provide a conceptual basis for integrating diverse measures into a self-consistent framework and for making meaningful extrapolations across time and space. The three approaches are:

- Projecting future trends using a non-spatial model with biophysical and socio-economic drivers (Land Use and Carbon Sequestration [LUCS] model)
- Projecting future trends based on a simple model of population growth and deforestation (the Forest Area Change [FAC] model)
- Projecting future trends based on a spatially geo-referenced model, using socioeconomic, demographic, and biophysical drivers

These approaches were applied to four pilot projects in developing countries: (a) Noel Kempff Climate Action Project in Bolivia (The Nature Conservancy and FAN; forest protection by averted deforestation and logging), (b) Rio Bravo Climate Action Project in Belize (Programme for Belize and The Nature Conservancy; averted deforestation and forest management), (c) Scolel Te, Mexico (agroforestry), and (d) Guaraqueca Climate Action Project in Brazil (TNC and SPVS; averted deforestation and forest degradation and forest restoration).

Leakage is another key issue that requires further research. Leakage is defined as the unanticipated increase or decrease in carbon emitted or sequestered outside a project's accounting boundary (i.e., the boundary defined for the purposes of estimating the project's net carbon impact) as a result of the project activities. For example, conserving forest that would have otherwise been deforested for agricultural land may displace the farmers to an area outside the project's boundaries. The deforestation and resulting carbon emissions occurring outside the project boundaries as a result of the project, is called leakage, and it has the effect of reducing a project's effectiveness. Developing strategies for quantifying and monitoring leakage is also one of the challenges that need to be overcome so that credible LUCF carbon-offset projects can be developed.

A major concern related to the use of LULUCF activities as carbon-offset projects is whether it is possible to identify, quantify and mitigate leakage or, even better, to prevent it. To date, two approaches have been used and proposed in the IPCC special report on LULUCF to identify and monitor leakage. (1) Monitoring by area—leakage may be monitored by expanding the area where activities must be monitored, which may be larger than the area on which project activities are implemented. Currently, most projects have either implemented strategies to minimize leakage or plan to monitor GHG benefits within a project boundary, and only estimate any potential leakage effects in some immediate surrounding area. (2) Monitoring by key indicators—alternately, it has been proposed that leakage can be tracked by determining key indicators for the demand driving

land-use patterns or management that leads to carbon emissions (such as demand for timber, fuelwood, or agricultural land). A review at the project level has suggested that leakage indicators can be developed by determining whether the project has displaced activities leading to carbon emissions, or substituted them.

The work reported on here had two goals: (1) comparing the effectiveness of identifying and quantifying possible leakage effects using both the approaches described above (area- and indicator-based tracking systems), based on data from the same projects described under baselines, and (2) developing new methodologies for leakage prevention or reduction, based on the findings of the first step. A conceptual framework for addressing leakage that takes into consideration the issues described above was developed.

Another key issue is permanence or duration of carbon storage in LULUCF projects. It is proposed that LULUCF projects are inherently risky because of the possibility of reversal of the carbon benefits. Several proposals have been put forward to address the permanence or duration issue, and all generally view LULUCF projects as providing a carbon storage service that could be "rented" over a certain period of time. In essence these proposals generally acknowledge the value of a temporary delay of carbon emissions and the need to provide credits in proportion to the delay time. However, many questions still exist with regard to permanence and risk. To address these issues, the proposals forwarded for dealing with permanence and risk need to be applied to existing projects to better understand their implications for project implementation. For instance, how does variation in project duration affect the development of credible baselines—the longer the project exists the more uncertain the baseline is likely to be out in the future. These different proposals for addressing permanence were applied to the same pilot projects described above.

Under this cooperative agreement, the research team produced numerous results:

- Adapted three existing models to be used to develop baseline scenarios for avoided deforestation projects. These models were used to extrapolate a variety of historic data sources over a 30-year time frame.

- Analysis of leakage for the same four projects used in the baseline work resulted in the development of a framework for assessing leakage potential. The results are reported in a peer-reviewed paper in Climate Policy (Aukland, L., P. Moura Costa, and S. Brown. A conceptual framework and its application for addressing leakage on avoided deforestation projects.).

- Two reports dealing with permanence and risk. One report compares the different proposal available with respect to their pros and cons and the other report applies each of the proposed methods to the existing pilot projects described in the baseline and leakage work.

Title of all the reports and papers resulting from this work and posted on Winrock's web site:

1. Hall, M. and A. Dushku. 2002. Spatial modeling of the averted deforestation baseline for the Noel Kempff Mercado Climate Action Project, Bolivia. Report to Winrock International.
2. Marzoli, W. 2002. Description of model and results for Forest Area Change (FAC) model to baselines for four sites. Report to Winrock International.
3. Marzoli, W. 2003. Modeling deforestation in the Parana state—Brazil. Report to Winrock International.
4. Hall, M. 2002. Spatial modeling of the averted deforestation and regeneration baseline for the Guaraqueçaba (Itaqui) Climate Action Project, Brazil. Report to Winrock International.
5. Dushku, A., S. Brown, and M. Hall. 2002. Modeling the deforestation and carbon emissions baseline in the Rio Bravo Conservation and Management Area Climate Action Project, Belize, 1993-2035. Report to Winrock International.

6. Hall, M. and J. Cornell. 2002. Spatial modeling of the averted deforestation baseline for the Scolel Té Region of Chiapas, Mexico, 1996 – 2030. Report to Winrock International.
7. Ruiz, F. N. 2002. Modeling deforestation baselines using LUCS for the Noel Kempff, Guaraquecaba, and Chiapas regions. Report to Winrock International.
8. Dushku, A. and S. Brown. 2002. Yolo and Sacramento County, California: Comparisons of grazing land baselines.
9. Aukland, L., P. Moura Costa, and S. Brown. 2002. A conceptual framework and its application for addressing leakage on avoided deforestation projects. Report to Winrock International.
10. Aukland, L. and S. Brown. 2002. Report on Leakage for the averted deforestation component of the Noel Kempff Climate Action Project. Report to Winrock International.
11. Aukland, L. and P. Moura Costa. 2002. Review of methodologies relating to the issue of permanence for LULUCF projects. Report to Winrock International.
12. Aukland, L. and P. Moura Costa. 2002. EcoSecurities carbon accounting calculator: Comparing methodologies for addressing non-permanence. Report to Winrock International.