ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. xx, pp. xxx–xxx, 2014
0305-750X/

http://dx.doi.org/10.1016/j.worlddev.2014.03.006

Environmental Income and Rural Livelihoods: A Global-Comparative Analysis

ARILD ANGELSEN
Norwegian University of Life Sciences, Ås, Norway
Center for International Forestry Research, Bogor, Indonesia

PAMELA JAGGER
University of North Carolina at Chapel Hill, USA
Center for International Forestry Research, Bogor, Indonesia

RONNIE BABIGUMIRA
Norwegian University of Life Sciences, Ås, Norway
Center for International Forestry Research, Bogor, Indonesia

BRIAN BELCHER
Center for International Forestry Research, Bogor, Indonesia
Royal Roads University, Victoria, Canada

NICHOLAS J. HOGARTH
Charles Darwin University, Australia
Center for International Forestry Research, Bogor, Indonesia

SIMONE BAUCH
Norwegian University of Life Sciences, Ås, Norway

JAN BÖRNER
University of Bonn, Germany
Center for International Forestry Research, Bogor, Indonesia

CARSTEN SMITH-HALL
University of Copenhagen, Denmark

and

SVEN WUNDER *
Center for International Forestry Research (CIFOR), Rio de Janeiro, Brazil

Summary. — This paper presents results from a comparative analysis of environmental income from approximately 8000 households in 24 developing countries collected by research partners in CIFOR's Poverty Environment Network (PEN). Environmental income accounts for 28% of total household income, 77% of which comes from natural forests. Environmental income shares are higher for low-income households, but differences across income quintiles are less pronounced than previously thought. The poor rely more heavily on subsistence products such as wood fuels and wild foods, and on products harvested from natural areas other than forests. In absolute terms environmental income is approximately five times higher in the highest income quintile, compared to the two lowest quintiles.

Key words — forests, household income surveys, inequality, poverty

1. INTRODUCTION

Rural households throughout the developing world use food, fuel, fodder, construction materials, medicine, and other

* We thank the 33 PEN partners and their teams for providing data to this study. Financial support to the PEN project was provided by ESRC-DFID, DANIDA, USAID (BASIS-CRSP), IFS, and CIFOR. Three anonymous reviewers provided useful suggestions to a draft version of this article.

Please cite this article in press as: Angelsen, A. *et al.* Environmental Income and Rural Livelihoods: A Global-Comparative Analysis, *World Development* (2014), http://dx.doi.org/10.1016/j.worlddev.2014.03.006

products from forests and other natural, non-cultivated environments to meet subsistence needs and generate cash income (Byron & Arnold, 1999; FAO, 2008; Kaimowitz, 2003; Sunderlin *et al*., 2005; World Bank, 2004). Quantifying the relative and absolute contribution of environmental income to total income portfolios is important for understanding the livelihoods of rural people, the extent and determinants of poverty and inequality, the welfare implications of the degradation of natural resources, and for designing effective development and conservation strategies (Angelsen & Wunder, 2003; Jagger, Luckert, Banana, & Bahati, 2012; Oksanen & Mersmann, 2003; Vedeld, Angelsen, Sjaastad, & Berg, 2004). Overcoming current knowledge gaps in these areas requires moving beyond the current primarily case study-based state of knowledge on the importance of natural resources to overall livelihoods strategies.

This paper presents results from the Poverty Environment Network (PEN) research project, coordinated by the Center for International Forestry Research (CIFOR). PEN used a standardized set of village and household-level questionnaires designed to elicit comprehensive data about the importance and role of environmental income in rural livelihoods. Our sample includes 7978 households from 333 villages in 24 developing, tropical and sub-tropical countries across three continents (Latin America, Asia, and Sub-Saharan Africa). The data collection was done by 33 PhD students and junior scholars; the research design and methods were developed by an interdisciplinary team of scientists. The hallmarks of the data collection effort are detailed questions on all household income sources, using short (1–3 months) recall periods, and quarterly visits to households.

Our analysis addresses three broad questions. First, how much does environmental income contribute to rural households' income portfolios in different study regions? Second, how does reliance on environmental income vary with different levels of income, including its influence on income inequality? Third, what household-level characteristics and contextual variables affect the magnitude and relative importance of environmental income? Our findings have important implications for how we understand rural livelihoods and how we should design interventions that affect access to and use of natural resources.

2. ENVIRONMENTAL INCOME AND RURAL LIVELIHOODS

Seminal studies published over a decade ago (Campbell *et al*., 2002; Cavendish, 2000) brought our attention to what Scoones, Melnyk, and Pretty (1992) and Campbell and Luckert (2002) refer to as "the hidden harvest"—the diversity of goods provided freely from the environment, i.e., from non-cultivated ecosystems such as natural forests, woodlands, wetlands, lakes, rivers, and grasslands. The literature identifies three primary roles for environmental income in supporting rural livelihoods: (i) supporting current consumption, (ii) providing safety-nets in response to shocks and gap-filling of seasonal shortfalls, and (iii) providing means to accumulate assets and providing a pathway out of poverty (Angelsen & Wunder, 2003). This paper focuses on the first aspect, while Wunder, Börner, Shively, and Wyman (2014) addresses the second. The third aspect is best addressed with panel data, but these are scarce in existing studies (c.f. Jagger, 2010).

During the past 10–15 years, research on environmental income has gained momentum, and a large share of this literature focuses on forests. Studies from Africa,[1] Asia,[2] and Latin America[3] find that forest and non-forest environmental income makes significant contributions to livelihoods in most rural settings. Most of these studies focus on livelihood strategies, forest or overall environmental dependence, non-timber forest products (NTFPs), or conservation and development issues. An early synthesis of 54 studies estimated an average forest income contribution of 22%—the third most important income source after off-farm activities (38%), and agriculture (crops and livestock combined) (37%) (Vedeld, Angelsen, Bojö, Sjaastad, & Berg, 2007; Vedeld *et al*., 2004). More recent studies[4] estimate forest income shares ranging from 6% to 44% of total income. Conceptual discussions of the role and potential contributions of forests to livelihoods include Angelsen and Wunder (2003), Belcher and Schreckenberg (2007), de Sherbinin *et al*. (2008), Shackleton, Shackleton, and Shanley (2011); and Sunderlin *et al*. (2005).

Despite this growing literature, methodological heterogeneity and bias in study locations make it difficult to generalize about the overall importance of environmental income to rural livelihoods in developing countries. In their meta-analysis of forest income studies, Vedeld *et al*. (2004: p. xiv) noted that "[t]he studies reviewed displayed a high degree of theoretical and methodological pluralism" and "methodological pitfalls and weaknesses [were] observed in many studies." Jagger *et al*. (2012) demonstrate in a methods experiment in Uganda how alternative data collection methods—a quarterly income survey (PEN) and a one-time household-level participatory rural appraisal—in the same study population can yield sectoral income estimates that differed up to 12 percentage points. Specific limitations of forest income studies include: long (e.g., one-year) recall periods underestimating or seasonally biasing estimates (Jagger *et al*., 2012; Lund *et al*., 2008), inconsistent operationalization of key variables (e.g., definitions of forest, NTFPs, etc.), incompatibilities in methods (Vedeld *et al*., 2004), and survey implementation problems (e.g., varying intra-household respondents) (Fisher, Reimer, & Carr, 2010). Finally, most studies are from dry-land sub-Saharan Africa, with Latin America in particular being underrepresented in the literature. The PEN project was designed to address the problems of methodological incompatibility, weak data collection, and lack of representativeness as observed in the literature.

PEN was also designed to address questions of the relative and absolute importance of environmental income across different wealth groups. The literature suggests that absolute environmental income rises with total income, while relative environmental income (i.e., the share of environmental income in total household income) decreases—i.e., household's environmental "dependence" or "reliance" decreases with higher incomes (Cavendish, 2000; Escobal & Aldana, 2003; Mamo *et al*., 2007; Neumann & Hirsch, 2000; Vedeld *et al*., 2007).

The forest "safety net"[5] *vs*. "poverty trap" debate focuses on whether high environmental reliance serves as a safety net by preventing poor households from falling into deeper poverty, or whether inferior good characteristics of forest resources keep households trapped in poverty (Angelsen & Wunder, 2003; Barbier, 2010; McSweeney, 2004; Pattanayak & Sills, 2001; Paumgarten, 2005). High dependence on natural resource extraction by the poor is often associated with asset poverty and lack of access to key markets (Barbier, 2010). Factors such as market access are exogenous to the household, suggesting that the "safety net" interpretation is more appropriate than the "poverty trap" interpretation. Angelsen and Wunder (2003) argue that environmental reliance could be justifiably labeled as a "poverty trap" only in cases where alternative livelihoods strategies exist, but where policies,

Please cite this article in press as: Angelsen, A. *et al.* Environmental Income and Rural Livelihoods: A Global-Comparative Analysis, *World Development* (2014), http://dx.doi.org/10.1016/j.worlddev.2014.03.006