Appendix 1. Supplementary text on case study selection and policy landscape for Garrett et al. "Explaining the persistence of low income and environmentally degrading land uses in the Brazilian Amazon."

A1.1 Case study selection

Santarém and Paragominas were chosen for this study because they are fairly representative of the dynamic and diverse agricultural-forest frontiers found throughout the Brazilian Amazon (Valentim and Garrett, 2016). In these two regions export-oriented soy production has been introduced into a region long inhabited by staple, fruit, and horticulture producers and cattle ranchers, resulting in a wide array of agricultural activities. Both regions are relatively consolidated, with decreasing, but persistent rates of deforestation of primary vegetation. There is a mixture of private property and land in agrarian reform settlements and a wide range of farm sizes. Both regions have seen in-migration from all regions of Brazil and of farmers with very different socioeconomic backgrounds and assets. Yet Santarém and Paragominas have slightly different histories. Santarém, is a much older city, once the center of pre-Colombian civilization founded in 1661, while Paragominas was founded in 1959 (Gardner et al., 2013). Santarém is the site of a major soybean export terminal, while Paragominas is a hub for cattle ranching and an expanding silviculture sector. This diversity in backgrounds, assets, and land uses, both within and between regions, provides an ideal setting for statistical analysis.

Nevertheless, these two regions are unique in terms of the high level of attention they have received from environmental non-governmental institutions. In 2004 Santarém became an international icon of Amazonian deforestation for soybean production when the Cargill soybean terminal was built there (Greenpeace, 2006). A few years later Paragominas was placed near the top of the government's "blacklist" of municipalities with extremely high deforestation rates. Counties on the blacklist were prohibited from accessing agricultural credit until they reduced their deforestation levels. Both municipalities are now undertaking ambitious private-public partnerships to reduce deforestation for agriculture. In Santarém a partnership between the Nature Conservancy and Cargill has focused on improving the sustainability of soybean production and reducing deforestation (Garrett et al., 2013). The Município Verde (Green County) initiative in Paragominas has focused mainly on improving cattle production systems, particularly on large properties (Viana et al., 2016). The novel environmental governance initiatives present in these regions have engaged local farmers' groups and governments in a discussion around improved land use sustainability and aided our ability to conduct surveys in the region (Gardner et al., 2013). They have also created a community through which results of our analysis can be communicated. Thus, while both of these regions represent fairly unique cases in terms of their political context, they are important for study because they have substantial promise to achieve meaningful change in land use outcomes and may serve as a useful example for other regions in the Amazon.

A1.2 Existing Brazilian agricultural and environmental policy

The Brazilian government has invested heavily in the expansion and modernization of Brazilian agriculture since the 1970s through several different policy mechanisms. The bulk of support for producers stems from the National Rural Credit System, which provides low interest loans for all aspects of farm production including operation, storage, maintenance, and investment (Garrett and Rausch, 2015). Minimum price supports have been established for certain crops, such as soybean and corn, and the government will purchase grains from farmers at this minimum price when market prices plunge (Damico and Nassar, 2007). The government also supports agriculture through research and development led by the Brazilian Agricultural Research Corporation (EMBRAPA).

There are a number of federal agricultural policies and programs designed specifically to support "family-farmers", extractive families and artisanal fishers in the country. Brazilian law 11,326 defines small family farmers as farmers who possess up to 400 hectares; use predominantly family labor in the economic activities of their farms; and rely primarily on farm activities for their household income. In 2006, family farmers accounted for 84% of the number and 24% of the area of the rural establishments (IBGE, 2006). The National Program for Strengthening Family Agriculture (PRONAF) provides subsidized rural credit for individual or collective projects that generate income for family farmers and agrarian reform settlers. The program has the lowest interest rates of any source of rural financing (~1%) in the country and covers both costs and investments in farm management and value added activities. PRONAF is linked to the technical assistance programs because upon being funded families are supposed to contact a state Rural Technical Assistance and Rural Extension agency to obtain a Declaration of Fitness for PRONAF (DAP). For beneficiaries of land reform and agrarian credit, the farmer must seek approval from the National Institute of Colonization and Agrarian Reform (INCRA) or the State Technical Unit (UTE). In 2010, the President of Brazil approved Law 12,188, which established the National Policy of Technical Advisory and Extension Services for Family Agriculture and Agrarian Reform (PNATER). The goal of this policy is to improve family farmers' food security and wellbeing, increase agricultural production, and conserve the environment through the provision of "participatory, multidisciplinary, equitable, and culturally appropriate" public advisory and extension services. This Law allows the government to make contracts with public, private and non-profit organizations accredited by the State Councils for Sustainable Rural Development, or a similar body for the provision of advisory and extension services (Brasil, 2010). In 2013, Brazil also passed Law 5,740 to create a National Agency of Technical Advisory and Extension Services (ANATER) with the goal of implementing the policies related to rural advisory and extension services for sustainable development. The government helps reduce risk for family farmers through the Insurance for Family Farmers (SEAF) program. SEAF provides insurance to farmers who adopt technologies that conserve natural resources on the farm and reduce their vulnerability to climatic fluctuations. Finally, Brazil's Program for the Sustainable Development of Rural Territories (PRONAT) creates new "Territories of Citizenship" to help define the needs of each territory. This policy mechanism is a promising vehicle for the improved asset classification system proposed in the main text. Despite the abundance of policies designed to help poor farmers, the reach of most programs is limited and few farmers outside of the South receive services.

Farms in the Legal Amazon region of Brazil are required by the Forest Code (Law 12,651) to set aside 80% of their forest area as a Legal [conservation] Reserve (although an amnesty is provided to many properties that cleared more than 80% of their original forest prior to 2008). Riparian areas and steep slopes must also be conserved in Permanent Preservation Areas. In the *Cerrado* portions of the Legal Amazon, the law requires 35% of the land to be conserved in the Legal Reserve. In the *Campos Gerais* of the Legal Amazon and other biomes the law requires 20% of the property to be protected. The Forest Code is enforced directly through fines for illegal activity, but also indirectly through restrictions on access to credit where producers are not in compliance (Garrett et al., 2013). In 2013 the Federal Government also launched a program requiring all farmers in the country to become registered in a Rural Environmental Registry (CAR), expanding what was once a program limited to states such as Pará and Mato Grosso. The goal of the program is to identify what steps need to be taken to bring properties into compliance with existing environmental regulations. Possession of a CAR will become a prerequisite for obtaining federally subsidized agricultural credit throughout the country, as it already is in the Amazon biome.

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