



**Figure 2. Dominant land-use trajectories for Mato Grosso. The foci of this paper are transitions to row-crop agriculture and intensification within existing croplands.**

including shifting cropping patterns, transforming pastures to croplands, selecting new cultivars, controlling weedy growth and pests, using irrigation, and adding nutrients (Gregory et al. 2002; Keys and McConnell 2005). A change in cropping-pattern intensity, such as increased plantings of the same crop or a shift in cultivars, is a common type of intensification well documented in other parts of the world (Turner and Ali 1996). In Mato Grosso, increased production per area from intensification occurs by changing cropping patterns from single cropping (typically soybean) to double cropping (typically soybean followed by corn) in one growing season, enabled by the use of fertilizers in the double-cropping system (Fundação Agrisus 2006). Quantification of the space–time dynamics associated with expanding croplands and changing cropping patterns is critical for many areas of ecological assessment and agricultural sustainability, including improved estimates of greenhouse gas emissions, regional climate modeling, hydrological cycling, biodiversity monitoring, and agricultural soil fertility.

To document and understand land-cover and land-use change over broad spatial and temporal scales, we have come to rely on remote sensing, particularly in large areas such as the Amazon (Adams et al. 1995; Alves 2002; Skole and Tucker 1993). Since 1988, the Brazilian government has used remote sensing analyses to track deforestation for enforcement of forest protection laws, often with great success but also with some uncertainty because of relatively infrequent repeated measurements, the limitations of validation over such a large and remote area as the Amazon, and conservative detection techniques used to minimize false positives (INPE 2008). Today, we can reduce the error in these estimates using higher-frequency observations provided by the Moderate Resolution Imaging Spectroradiometer (MODIS; Justice 1998) and even distinguish among pasture, crops, and natural land cover (Anderson et al. 2005; Brown et al. 2005; Galford et al. 2008; Morton et al. 2005). Recent studies using remote sensing data have moved beyond