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POLICY BRIEF

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Food Production and Environmental Health in Southeast Asia: The Search for Complementary Strategies

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Growing food demands and escalating environmental stresses create a series of challenges throughout Southeast Asia. Projected population and consumption patterns strongly suggest that food production will have to increase markedly in the coming decades to avoid a reduction in the quality of life and pronounced food insecurities in various parts of the region. Efforts to increase food production may in turn place greater stress on vital environmental systems and cause a range of negative and lasting corollary effects. Such a scenario is far from inevitable, however, and many tools are already in existence that can help the region concurrently achieve greater food producing capacities and the environmental conditions necessary to sustain future social progress. This policy brief offers analyses that address how such a future can be attained, and presents recommendations for those in search of complementary environmental and food production strategies.

Introduction

Populations are growing and becoming more urban throughout much of the developing world, with the Southeast Asian region proving no exception. One result of this seemingly inescapable trend is that more food will have to be produced by rural communities that continue to decline in size relative to their city-dwelling neighbours. This is true both in domestic contexts, where rural hinterlands will feed urban centres of business, technological advancement and trade, and in international food markets, where countries with high rural agricultural production capabilities will be sought after by countries that have significant food importing needs. While the processes by which these trends play out are complex, varying and at times unpredictable, it is clear that food production must increase.

In Southeast Asia, this reality exists in the context of significant levels of environmental stress, concerns that large-scale high-tech farming methods cause a range of second- and third-order effects on the environment and human well-being, and a growing recognition of the role of agriculture in exacerbating climatic challenges. Advocates of greater environmental awareness and policy recognition are among the most vociferous of those calling for a reassessment of agricultural production strategies and often propagate the potential value of 'traditional' farming methods as the pathway to a more sustainable relationship between environmental health and food production, particularly in the context of a changing climate.

While food production policies certainly require new thinking in the face of contemporary realities and future trends, the perpetuation of or return to traditional farming methods and retreat from technological possibilities represent a misguided policy solution. Agrotechnology, rather than solely a source of environmental concerns, should be viewed as an integral part of efforts to produce adequate food in a sustainable manner – both on large and small scales. This policy brief focuses on the intersection between food production and environmental health, and seeks to illuminate ways in which technological advances in the agricultural sector can be effectively implemented in Southeast Asia. The first section briefly outlines growing global food requirements and environmental pressures, which have both direct and indirect implications for Southeast Asia. The next section explores an ongoing discursive debate on environmental health and advances in agrotechnologies. The final section posits policy recommendations that are geared towards balancing the region's environmental and food futures.

More Mouths, Less Land

A joint study by the World Resources Institute (WRI) and International Food Policy Research Institute (IFPRI) has revealed the degree to which global arable land per person has shrunk since the mid-20th century. At mid-century, this figure stood at approximately 0.45 hectares (ha) per person, a size around which it had likely hovered for centuries. By 1997, the figure had fallen to 0.25 ha per person and it is projected to drop to roughly 0.15 ha per person by 2050. While alarming, this trend is unsurprising given the world's rapid population growth, impressive gains in global economic production and the attendant large-scale land conversions such expansion has necessitated. Reductions in cropland per person are also partly a function of agricultural success. In many parts of the world, including throughout much of Asia, remarkable improvements in agricultural output per ha have underwritten both population growth and economic expansion by allowing more food to be grown on less land.

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Despite such successes, pervasive insecurities in food systems continue to exist throughout much of the developing world, manifested both as hunger and undernutrition among the most vulnerable citizens, and acute food policy challenges at the state and regional levels. These challenges are set to become more pronounced, as demographic, economic and lifestyle trends ensure that global food requirements will increase dramatically in the coming decades; roughly twofold by 2050 according to the Food and Agriculture Organization of the United Nations (FAO). Increasing purchasing power in developing states compounds food supply challenges, as it is accompanied by the desire for more diverse foods and higher consumption levels of meat, fish, dairy products and processed foods. These food needs come at a time of growing evidence, awareness and policy attention concerning the state of natural environments throughout much of Southeast Asia and the world.

Anthropogenic effects on natural environments are an ever-increasing and in some ways inescapable part of modern human activities. Altering environments is of course not new and has been a fundamental element of social progress throughout humankind's history. During the 20th century, environmental changes have gained momentum as societies have been able to harness new territories for living, transportation and resource extraction. These advances have enabled remarkable shifts in technological capabilities, helped foster an increasingly interconnected system of global production and improved the quality of life for untold numbers of people. Environmental changes have also, however, created unparalleled contemporary challenges. Fisheries throughout the world are depleted from decades of unsustainable fishing and stressed further by habitat destruction and climatic changes. Forests, which are key regulators of hydrological cycles, soil systems and many freshwater bodies, have declined by roughly one-fifth globally since 1900 and continue to face pressure from human activities. Perhaps most tellingly, through unprecedented population growth, advanced technological capabilities and growing resource needs and desires, humans are now estimated to move sediment at a rate that is an order of magnitude higher than all natural processes combined, and have now altered over half of the world's non-glaciated land. The fragility and interconnectedness of natural processes around the world assure that continuing social progress is contingent upon finding a balance between the needs of humanity and the sustainability of key environmental systems. Realising this balance is especially critical in the food production sector.

The Environment, Technology and Food

It is at the intersection of environmental health and agricultural production strategies that controversies over the future of food systems abound. Addressing modern large-scale farming methods, environmentally focused voices call attention to the high greenhouse gas emissions released by some food producing and distribution practices, the degradation and depletion of vital freshwater systems to meet agricultural needs and the large-scale conversion of formerly valuable ecosystems to support corporate farming operations. Arguments point out that decades of agricultural intensification have had serious side-effects, with the overuse of nitrogen-based fertilisers and high inputs of phosphorus, insecticides, fungicides and heavy metals all creating lasting problems for soil and freshwater systems, and overall nutrient flows throughout food chains. Working from these critiques, many in the environmental sector and beyond now advocate a return to, or perpetuation of, more 'traditional' small-scale farming techniques. These voices contend that such traditional techniques are essential for reducing the ecological footprint of agricultural sectors.

Critiques in the name of environmental stewardship also extend forcefully into issues associated with genetically modified organisms (GMOs). GMOs are organisms in which genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination. GMOs have spurred major protests, and in certain places, strict regulation and censure. Fears concerning growing influxes of undesirable insects, detrimental effects on beneficial insects, the potential introduction of new plant pathogens, the spread of herbicide-resistant genes to other plants, and adverse consequences for plant biodiversity are among the most prevalent cautionary issues raised regarding the wisdom of planting GMOs. Like other areas of agrotechnology, these natural scientific concerns over GMOs combine with a range of socially based arguments that seek to problematise technologically advanced agricultural strategies.

GMO issues raise social questions of ethics, biosafety for food consumers and the domination of GMO seed banks by a relatively few monopolistic companies. Ethical arguments question the morality of this new frontier of changes to natural agricultural patterns, consumer voices assert a level of uncertainty on the health impacts of GMOs and economically based positions warn that the domination of multinational corporations (MNCs) such as Monsanto creates intellectual property problems and leaves food consumers susceptible to the whims of private businesses. Outside the GMO sector, other agrotechnologies have been

disparaged on the grounds that they have not always improved the circumstances of the world's most food insecure populations. Hunger continues to plague much of the developing world despite significant gains in overall food production and per ha yields, the reasons for which concern access to adequate food rather than the existence of adequate food supplies. The Green Revolution, a period of unprecedented expansion in food production, has been singled out for exacerbating food access inequalities (particularly in Latin America), and some suggest that runaway agrotechnologies driven by corporate greed will lead to greater food access inequalities in the future.

Critiques of the record agricultural expansion during past decades illuminate many pitfalls that should be considered when formulating future food production strategies. They do not, however, justify retreating from technological progress in food production sectors. The impressive growth in food yields over the past several decades have no doubt been accompanied at times by social injustices, gross environmental oversights and instances of outright negligence. These experiences, however, must not be allowed to undermine the potential value of agrotechnologies for both food production and environmental stewardship.

Agrotechnology provides environmentally prudent tools for reducing water usage through targeted low-volume irrigation systems, combating soil erosion through less invasive tilling practices and increasing yields per ha so that fewer areas of land require conversion to agriculture. Technologies can also contribute to climate change mitigation strategies. These include farming practices that seek to sequester increasing levels of atmospheric carbon, those that emit lower volumes of powerful greenhouse gases such as methane, and technologies that have the second-order effect of cutting transportation emissions through creating food production possibilities in new locations. Regarding climate change adaptation, emerging farming techniques and more robust crop varieties can create greater resilience to predicted changes in surface temperature, precipitation patterns and growing seasons.

Low-impact 'precision' farming technologies and practices, when applied in appropriate ecological and social settings, have the potential to contribute to such food security while maintaining responsible environmental principles. Reasoned approaches that apply modern technological offerings, such as soil sensors that gauge the need for water and nutrients, and judiciously apply them; information technologies that monitor complex farm systems and provide relevant information to farmers in real time; and labour-reducing farm machinery, can all enhance resource-use efficiencies and produce greater quantities and qualities of produce in large-scale agricultural systems. In smaller-scale operations, GMOs that are matched to the physical and climatic conditions in which they are applied, increased dissemination of proven best practices, and access to basic resource efficiency technologies can improve yields while reducing environmental impacts. Such symbiotic approaches are essential for meeting the food needs of Southeast Asia, and require multiple movements in policy sectors to address the needs of the region's many agricultural contexts. The following recommendations offer potential guidelines for such policy movements.

Recommendations

- ***Sustainably close yield gaps, in both large- and small-scale agricultural sectors in order to lower environmental impacts and avoid the need to bring large areas of new land under cultivation***. Yield gaps refer to the difference between realised productivity and the best yields that can be achieved using current genetic material and available technologies and management. It has been estimated that in irrigated parts of Southeast Asia, average maximum climate-adjusted rice yields are 8.5 tonnes per ha, but actual yields are approximately 60 per cent of this figure. In the past, such yield gaps have typically closed as a result of genetic improvements through conventional breeding or the greater use of external inputs such as energy, fertiliser, feed, pesticides and irrigated water. Moreover, overall agricultural production has often been increased not by closing yield gaps but by clearing new lands for farming – an option that is increasingly unsustainable in Southeast Asia. Closing yield gaps in the contemporary setting should move away from these strategies and towards employing enabling technologies that can concomitantly increase resource-use efficiencies, counter instabilities caused by climatic changes and lower environmental impacts. These strategies have the potential to produce more food from the same area of land while reducing environmental impacts, a process known as sustainable intensification. Sustainable intensification is an encompassing concept, and should be the fundamental goal from which other food producing strategies extend in Southeast Asia.

- ***Harness the potential of GMOs***. GMO usage is currently dominated by countries in North and South America, with Southeast Asia only scratching the surface of what is possible with bourgeoning genetic advances. The previously illuminated criticisms of GMOs are far from insurmountable and in some cases overblown. Existing and planned GMO plants reflect fairly

simple genetic modifications, such as the insertion of genes for herbicide resistance and others that act as pest insect toxins. Assertions that such modifications create pronounced risks from emergent pathogens, expand herbicide-resistant genes in unwanted plants, and have detrimental consequences for plant biodiversity have not been supported empirically. Public health concerns have also proven largely unfounded in countries that deploy GMOs on a large scale, and such issues can be all but negated through extensive testing. The key to harnessing the potential of GMOs is thus to gain public trust in these products through transparent monitoring processes and effective communication, and to put economic structures in place that will encourage their usage. These economic systems hinge upon public-private partnerships.

- ***Create public-private partnerships that will facilitate GMO deployment and effective agrotechnology research platforms***. The primary challenges regarding GMOs are not environment-, health- or food-related but economic, centring upon fears of monopolistic control, ambiguous public-private relationships, competition in the marketplace, and patent and intellectual property rights. Difficult questions exist, for example, regarding whether the germplasms that are essential for GMO development should be kept in the public domain (as many currently are in the developing world), or should be patented so that private research and development (R&D) funds will be more free-flowing (giving greater control to powerful MNCs). Effective public-private partnerships are the key to overcoming these and other complicated issues relating to GMOs. Private sector companies must have access to patents for products that they develop so that financial incentives for future R&D into GMOs continue. However, mechanisms must be put in place that prevent private companies from hoarding patents in ways that prevent academic research institutions and national agricultural research systems (NARS) from using the same scientific processes to develop GMO products that would benefit their respective countries. A delicate balance in intellectual property legislation and enforcement is therefore needed in the GMO sector. Effective public-private partnerships that contribute to such a balance will seek to collaborate on GMO-enabling technologies during early 'pre-competitive' phases of research and foster progress through greater transparency in objectives and methods over the course of product development.

- ***Deploy agrotechnologies in appropriate contexts***. Agricultural contexts vary throughout the region. Research- and policy-driven institutions and government offices should seek to delineate the causes of yield gaps, identify new technologies that could help utilise the region's scarce resources more efficiently while concomitantly increasing and stabilising crop and livestock yields. This would require investigating the spare capacity within Southeast Asia in terms of land and resources needed to feed its populations, surveying urban agriculture possibilities, and contributing strategies on ways in which food production and resource productivity can be increased in high-potential areas in the region. In short, such a strategy would attempt to determine specific food production regions that could benefit from the application of certain agricultural technologies. Upon making these determinations, projects should then look to facilitate the movement of agrotechnologies into the appropriate areas through organising technology brokering forums, linking investors with technology developers, and engaging with other relevant governmental and non-governmental entities.

- ***Seek efficiency in food systems through analysing a range of social and natural variables***. Public funding and institutional support should be allocated to create greater efficiency in food production systems throughout all Southeast Asian countries. This necessitates respecting the myriad factors and processes that affect agricultural production and access to food in individual parts of the region. The pursuit of efficient food systems requires sound management of natural resources and the fostering of synergies among livestock, agroforestry and food production, both on large and small scales. Since future agricultural growth must come from intensification rather than spatial expansion to be sustainable in Southeast Asia, the efficient use of water, energy and labour, and the integration of soil, water, nutrient and pest management, are essential. Promoting food system efficiency also necessitates a firm recognition of the socioeconomic realities of farmers (including gender issues). Responding to these realities will often require improvements in infrastructure for the transportation and storage of food products, and micro-insurance options for farmers seeking social safety nets. Such strategies are valid not simply in the pursuit of social justice, but also create conditions in which greater agricultural efficiency can flourish.

Conclusion

The challenge of meeting global and regional food demands in a sustainable way necessitates knowledge-intensive approaches and the use of advanced technologies. Confidence in modern agrotechnologies and biotechnologies must be fostered through rigorous science, unequivocal

transparency and effective public outreach strategies. Ample evidence exists that sustainability and growing food production yields can progress in tandem. In Southeast Asia, such dual-track progress is crucial.

About the Author

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