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The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 10 member countries: Cambodia, China, Indonesia, Laos, Malaysia, Papua New Guinea, the Philippines, Sri Lanka, Thailand, and Viet Nam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to policymakers.

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Vegetables, Wetlands And Waste: Ensuring Food Safety In Phnom Penh, Cambodia

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Across Southeast Asia, consumers and scientist are increasingly concerned about the chemical contamination of food. From cancer-causing agents in cow's milk to pesticide residues on fruit, tainted food is a major environmental problem. In Phnom Penh, this is a particularly worrying, since a large percentage of the city's vegetables are grown in wetlands that are also used to absorb municipal and industrial waste. This means that the vegetables in many local markets pose a serious health hazard, since they are contaminated with heavy metals and other toxic pollutants. →

A summary of EEPSEA Research Report 2004-RR5, *Avoiding Adverse Health Impacts from Contaminated Vegetables: Options for Three Wetlands in Phnom Penh, Cambodia* by Sideth Muong, Assistant to the Director General, Ministry of Environment of Cambodia, N°48, Bd. Sihanouk, Phnom Penh, Cambodia.
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Relocation would

→ A new study has looked at ways of halting the production of this contaminated food, while adequately compensating those farmers affected. The report was done by Sideth Muong from the Cambodian Ministry of Environment. It finds that the most cost-effective solution would be to re-locate the farmers who are currently cultivating the polluted wetlands and to set up an irrigation system for their new fields that would use treated household wastewater. It recommends that relocation be accompanied by a public awareness campaign to explain the dangers of consuming contaminated vegetables.

Wetlands and Waste

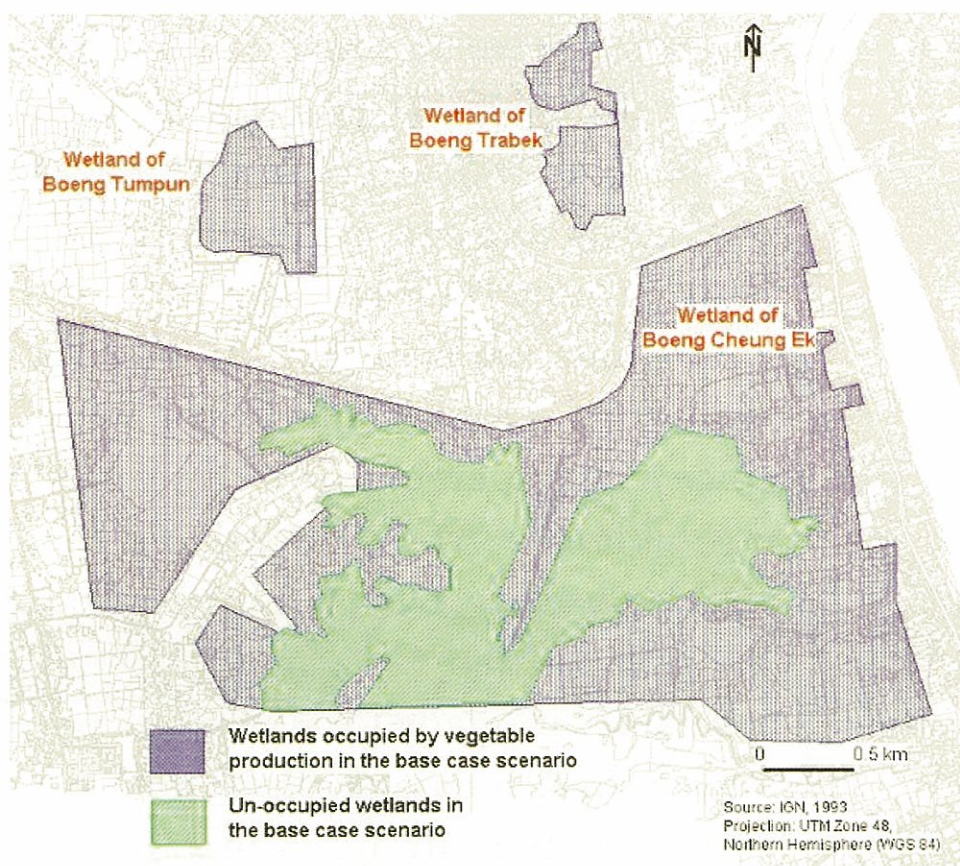
Muong and his team looked at the wetland areas of Boeng Trabek, Boeng Tumpun, Boeng Cheung Ek. These lie near the city of Phnom Penh and play a key role in absorbing floodwaters and in reducing pollution loads on surrounding waterways. Together, these wetlands receive a daily discharge up to 55,600 m³ of household wastewater from more than 653,000 inhabitants (equivalent to 6.6 tons per day of BOD₅ discharge) and industrial effluents from more than 3,000 installations.

The wetlands are used as a sewage sink because Phnom Penh has very

inadequate sewerage and no wastewater treatment facilities. The city's sewage network, mostly built in the 1960s, receives wastewater from households, storm water drains, and industrial plants. Ten percent of the effluent from this system flows directly into the Mekong River without any treatment. The remaining ninety percent is loaded into the natural wetlands around the city. Almost 300 farmers cultivate these wetlands and, between them produce twelve varieties of fresh vegetables. About 26 tons of these crops are produced daily, representing about 20% of the total

sold in Phnom Penh markets.

Farmers working these areas were found to make a reasonable living from their land. In particular, the farmers in Boeng Trabek earn up to USD 27 per farmer household per day, compared to a legal minimum salary in Phnom Penh of USD 1.5. Using data on farmers' gross revenues and overall costs, it was found that, over a 20-year period (at a 10% discount rate), the net present value of farmers' returns from farming was about USD 17,000 per household.



Wetland Use in the Base Case

provide many benefits

Present value (PV) of incremental net costs, ranked by c-e

Discount rate: 10%		Time period of PV: 20 years
Mitigation Options	PV of net costs (million USD)	PV of incremental net costs (million USD)
Relocation Option 2	-18.03	-13.05
Relocation Option 1	-17.78	-12.80
Conversion Option 1	-7.04	-2.06
Base Case Scenario	-4.98	0
Conversion Option 2	-2.46	2.52
Compensation Option	4.61	9.59

Investigating Cleanup Options

Given the significant health hazard that the contaminated crops produce, the principal objective of the study was to identify the best practical option for stopping the production of these vegetables. Five different ways to do this were assessed and their incremental net costs calculated. Once overall costs had been estimated, the five options were then compared to identify the most cost-effective (least costly) approach.

All the options assessed included enforcement measures that would stop any further edible vegetable production in the polluted wetland areas. Costs for public information programs to stop people buying any remaining contaminated produce were also included.

In the first of the options (compensation), all farmers would be allowed to remain on their farms, but would have to stop producing edible

vegetables. In exchange, they would get a compensation payment.

To calculate a fair level of compensation, three cost estimates were compared. These were: the compensation rate set by current policy; an evaluation of the farmers' willingness to accept compensation (obtained from interviews); and an estimate of the farmers' net cash flow. This comparison suggested that a compensation value of USD 4.0/m² would be fair.

Relocation and Conversion

The next two options involved the relocation of farmers to new agricultural lands, some of which are located on the Mekong river bank. Under these options, each farmer would get 0.4 ha. of new farmland. Houses and infrastructure would also be provided. In the first of the relocation plans (Relocation Option 1), clean water would be used for irrigation. In the second (Relocation

Option 2) treated household wastewater would be used.

The assessment of these two options included such factors such as the initial capital investment needed to create new farmlands, the incomes that farmers would earn from their new farms and any income losses incurred by farm relocation. The initial investment costs for both relocation options turned out to be very similar (about USD 11,000 per farmer).

The final two alternatives involved converting the way in which vegetable farms were used. In the first conversion option, farmers would be encouraged to grow aquatic plants such as water hyacinth and lotus on their farms. They would also be encouraged to grow decorative flowers in about 75 ha. of the wetlands of Boeng Cheung Ek. Because some of this land is perpetually flooded, the project would require land reclamation works to be carried out to

ensure year-round flower cultivation. Under the second conversion option, the production of aquatic plants and lotus would also be encouraged, but the 75 ha. for decorative flowers would be used for industrial parks instead.

Costs and Benefits

Cost-effectiveness analysis of the different options estimated their incremental net costs over a 20-year period (at a discount rate of 10%). The incremental net costs were the difference between the net costs of each option and those that would accrue in the 'business as usual' baseline situation. The lower the incremental net cost of an option, the more cost-effective it is. An option with a negative incremental net cost would yield greater economic benefits to farmers than the current (baseline) situation - i.e. it would leave farmers and society better off than they are now.

Relocation Option 2 turned out to be the most cost-effective, followed by Relocation Option 1, and

Conversion Option 1. If each farmer were to receive at least 0.4 ha. of new farmland under the Relocation Options, this would make the majority of them better off. Their net incomes would rise spectacularly, up to 360% relative to the baseline scenario. Furthermore, these options would bring improvements in income, health and environment for the farmers-factors that would compensate for any social impacts caused by the proposed move. Each farmer would receive about USD 7,868 in net benefits under relocation option 2 (compared with USD 1,686 in the base line scenario).

A Cleanup Strategy

The results of the study make a strong case for relocating farmers from the contaminated wetlands to practice agriculture in safer locations. Relocation is entirely feasible and would bring about many benefits: improving public health; providing a safer environment and better livelihood for the squatter/farmers; promoting suburban agriculture; and

creating a safe source of vegetables to replace imports.

But no matter how cost-effective it is, relocation would cost money - about USD 2.5 million. Of this, Muong estimates that the government could provide about three-quarters, leaving a funding gap of about USD 700,000. This is not a large sum for most aid agencies and projects like this that improve public health and the livelihoods of marginal groups are a high priority for donors. The author urges the government and foreign partners to come together to meet this urgent need.

Failure to take action today will be detrimental to consumers' health for decades to come. Heavy metals like lead and mercury are particularly harmful to children and pregnant women; they can lead to deformities and permanent mental impairment, among other effects. USD 700,000 does not seem too high a price to pay to free Phnom Penh's vegetables of these life-threatening pollutants.

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