



Assessing public demand for genetic resource conservation in the Czech Republic

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The social value of crop diversity conservation

The use of diverse genetic resources to breed improved crop varieties has been a key driver of agricultural productivity improvements in the past century. At the same time, the adoption of modern varieties has contributed to a substantial reduction in the number of traditional varieties grown in farmers' fields. Such genetic erosion has undermined the potential resilience of the global agricultural system by limiting the genetic resources available for breeding more productive and resistant crop varieties in the future. Claims that under-valuation of genetic diversity by the private sector are likely to lead to systematic underinvestment in this area suggest that robust economic studies of genetic resources are needed to ensure that more socially optimal investments are made in their conservation and use in the 21st century.

HIGHLIGHTS

- We use stated preference techniques to approximate the social value of crop diversity conservation activities in the Czech Republic, with data collection implemented through an online survey.
- Using a double-bounded dichotomous choice model to analyze our country-representative dataset of 1037 individuals, we find that Czechs are willing to pay about \$9 on average to collect and conserve additional crop diversity over a 10-year period.
- On a country-level, this corresponds to an aggregate WTP of about \$70 million - or about 4.5 times more than the costs of running the entire Czech genebank system for 10 years.
- The study illustrates an empirical approach of potential value for policymakers responsible for determining funding levels for genetic resource conservation.

This research focuses on the value that the Czech public places on conserving crop diversity *ex situ*, providing an approximation of the aggregate social benefits of plant genetic resource conservation in the Czech Republic. Most past studies have focused on the value of crop diversity on-farm, while few have used stated preference

techniques to investigate the social value of crop diversity held *ex situ* in field collections, cold storage, and cryopreservation facilities. The majority of studies have also elicited the preferences of farmers or cultivators for the conservation of crop diversity, and not those of the general public. Since most countries have public conser-

BOX 1 The Czech Republic national genebank

The Czech Republic's publicly held collections of plant genetic resources (PGR) are maintained through the National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity, which was launched in 1993 when the PGR collections of Slovakia and the Czech Republic were split. The leading institution of the Czech National Programme is the Crop Research Institute in Prague-Ruzyně, founded in 1952, which coordinates the activities of the 16 participating organizations.

At the end of 2012, the accessions in the Czech collections reached 52,600, and now number over 53,000. The majority of the Czech PGR collections are held by the Crop Research Institute, which maintains a little over half of the nation's accessions (around 26,700), including a large wheat collection and other cereal crops and some neglected and minor crops. The rest are divided between the other institutions participating in the Czech National Programme. Cereals comprise

about 40 percent of the total number of accessions, with vegetable accessions constituting 15 percent, legumes representing 11 percent of the accessions, and the rest being made up of fodder crops, fruit plants, potatoes and root crops, and others.

The Czech Republic is a Contracting Party to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), which requires members to provide access to certain types of crop diversity conserved through the national programme freely to those who request it for research, breeding and training, and also adheres to the associated Standard Material Transfer Agreement. The Czech Republic also joined the European Cooperative Programme for Plant Genetic Resources in 1983, which now includes 44 countries, and is also active in AEGIS, the European genebank integration project.

vation programs for crop diversity on the national level, however, the value placed by the general public on the conservation of crop varieties is also of interest.

In this analysis, we apply a broader approach to valuation by using stated preference techniques to derive an estimate of the social value of crop diversity conservation activities in the Czech Republic. By focusing on the Czech public as a whole instead of a given interest group (related to a specific crop or farmers as a group) or a specific use of genetic resources (with a demonstrated economic return), we aim to capture not a measure of the past or potential use value of crop diversity in a narrow sense but an approximation of the social value provided by genetic resource conservation, including other types of value including insurance, option, bequest and existence values – thus providing a rough estimate of total economic value provided to the agri-food system on a national level.

Synopsis of methods

Methodologically, we use a double-bounded dichotomous choice experiment to estimate how much Czechs are willing to pay (WTP) to fund the collection and conservation of additional crop varieties over a 10-year period. Single-bounded dichotomous choice experiments involve a single WTP question, while double-bounded dichotomous choice experiments include an additional follow-up WTP question depending on the first answer.

Preferences were elicited through an online stated preference survey conducted in the Czech Republic (n=1037) in July 2016. Survey participants (ages 18–69) were sampled from a properly managed online panel following international ESOMAR standards, using quotas for region, age, gender, education, and the size of the place of residence of the respondent to ensure that the sample was representative of the Czech Republic. The mean WTP figure from the Czech representative sample was multiplied across the adult Czech population ages 18–69 (about 7.5 million), using population figures obtained from the Český statistický úřad (the Czech Statistical Office) website (www.czso.cz) for 2015.

Table 1. Aggregate WTP figures and benefit-cost ratios for the Czech sub-sample¹

| Model | Estimated aggregate WTP | Benefit-cost ratio |
|---------------------------|-------------------------|--------------------|
| SBDC, protestors included | \$42 million | 2.8 |
| SBDC, protestors excluded | \$55 million | 3.8 |
| DBDC, protestors included | \$68 million | 4.6 |
| DBDC, protestors excluded | \$71 million | 4.9 |

¹These values are based on the “pure” WTP for a crop diversity conservation program, regardless of how many varieties would be newly conserved in a genebank. Total estimated benefits would be even higher by between \$3.5 million (DBDC without protestors) and \$3.7 million (DBDC with protestors). Current costs of running the Czech genebank were provided by Dr. Vojtech Holubec of the Crop Research Institute. Source: Authors, see Tyack and Ščasný (2018).

Estimates of social value

The mean willingness-to-pay is found to be 223 Czech crowns (Kč) for our main model, equivalent to \$9.08 (using an exchange rate of 24.62 Kč per dollar from the period of the study). The WTP is increasing in the number of crop varieties, by about 1.22 Kč per additional variety conserved (\$0.05), corresponding to only 0.5% of the WTP value for a conservation program, and implying that the total WTP is increased by 22 Kč (\$0.90, by ~20%) for the average number of varieties (18) and by 43 Kč (\$1.75, by ~40%) for the highest number of varieties it was possible to conserve in the contingent valuation experiment (35).

Our estimate of the public’s aggregate WTP for general crop conservation in the Czech Republic is 1.67 billion Kč, equivalent to about \$68 million. This estimate is more than 4.5 times higher than the cost of maintaining the current Czech crop diversity holdings for ten years (360 million Kč, equivalent to about \$14.6 million: personal communication V. Holubec).

Table 1 displays the estimated aggregate WTP for the four models we estimate including both single-bounded and double-bounded dichotomous choice models, with and without protestors, demonstrating that the most conservative estimate of social benefits from crop diversity conservation were always at least two times higher than the current costs of conservation. Protestors were defined as those who answered no for both choice tasks and additionally indicated in a following debriefing question that they did not trust the information provided; desired to have more information to make their decisions; or wrote in the comments that they had made a mistake in clicking the status quo.

Regardless of the model used (and whether or not protestors are excluded), the general finding of the study remains the same: Czechs are willing to pay several times more than the current levels of funding of the Czech genebank system for the conservation of the country’s crop diversity. The main and robust policy implication from this result is that the national genebank system produces social benefits in excess of the operational costs, and that the Czech public would support an increase in funding of the Czech plant genetic resources conservation program, if such an increase were able to secure the conservation of currently unconserved crop varieties in the country.

Concluding comments

By focusing on how the Czech public values crop diversity conservation activities, this experiment provides a broader welfare measure of the total economic value of crop diversity conservation in the Czech Republic than an approach focused strictly on farmers or plant breeders. It also captures the non-use values associated with genetic resources, such as insurance and option values, existence value, and bequest value.

On average, Czechs were willing to pay \$9 to collect and conserve additional crop diversity over a ten-year period, corresponding to an aggregate WTP in the Czech Republic of at least \$68 million – about 4.5 times more than the costs of running the entire Czech genebank system for 10 years. This result indicates that Czechs would be willing to pay more to expand the country’s crop diversity conservation program through the collection and conservation of additional crop varieties, and highlights the social value of the Czech Republic’s agricultural heritage, a



resource important for future efforts to adapt the country's agricultural sector to climate change.

This straightforward and relatively simple approach to estimating the social value of genetic resources could also be used in other countries and contexts to determine how well the current investments in the collection and conservation of crop diversity match the willingness of the public to pay for them. This information could be particularly useful in some European countries like Hungary, where uncollected crop varieties are likely still present in diverse home gardens, or in developing countries in Africa, Asia and Latin America. In such cases, applying a similar approach to estimating the social benefits associated with crop diversity conservation as derived here from a stated preference study may be compared with the current conservation costs of the given country's genebank

system to determine if the public would support such a program and be willing to pay for the collection and conservation of additional crop varieties. If such public support exists, the social planner could use this as justification for directing further resources towards the national crop diversity conservation program budget.

Further reading

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