POLICY BRIEF EVOCA #1

# Collective action critical for disease control in rural Africa

# Collective action critical for disease control in rural Africa

Covid-19, malaria, foot and mouth disease, Banana Xanthomonas Wilt, potato bacterial wilt and late blight... these are all infectious diseases that can potentially kill their host, whether that host is a human, animal, or plant. With the outbreak of Covid-19 in 2019 and the impacts of the global pandemic still fresh in our minds, it needs no explanation that infectious diseases can strike anywhere and affect anyone. Yet, the impact is largest in those places where people are most vulnerable. This holds true for the effect on the host, e.g. old and physically unhealthy people are more likely to die from COVID, and children from malaria; potato plants exposed to more environmental stress are more likely to die from potato wilt; and Boran cattle in poor condition have higher tick infestations that can cause tick-borne diseases. The indirect impact of infectious diseases is also largest on vulnerable people, think about the damage done to people and families whose incomes, food security, and livelihoods rely on the production of a crop or animal, or ability to commit to long days of physical work in the field, on construction sites, or in production facilities.

*Impact of banana Xanthomonas Wilt disease. Farmers abandoning plantations when unable to gain control over the disease (Photo: M. McCampbell).*

## African case studies provide scientific insights

This policy brief shares research findings of an interdisciplinary research programme titled 'Responsible life-science innovations for development in the digital age: '*Environmental Virtual Observatories For Connective Action*' (hereafter referred to as EVOCA) that was implemented between 2016 and 2021 by Wageningen University and Research, the Netherlands, together with international and local partner organizations. EVOCA developed and researched participatory monitoring systems, virtual platforms, and digital applications geared towards facilitating connective action regarding six different complex problems in four African countries (Rwanda, Kenya, Ghana, and Ethiopia). Four of these problems involved diseases and feature in this policy brief: Malaria in Rwanda, banana Xanthomonas wilt (BXW) in Rwanda, potato bacterial wilt and late blight in Ethiopia, and tick-borne diseases in Kenya.

## Building knowledge about diseases

### Infectious diseases are complex and multi-dimensional

Knowledge building about infectious diseases is often initially technical in nature, with a focus on developing biophysical and epidemiological knowledge and knowhow. EVOCA's researchers found similar patterns when analyzing the existing knowledge about the diseases on which they focused in their case studies; malaria, BXW, potato bacterial wilt and late blight, and tick-borne diseases.

### The social context in which an infectious disease hits and is dealt with matters

However, disease problems are essentially multi-dimensional and hence not just technological, biological, or biophysical in nature. Instead, diseases are equally embedded within economic, socio-cultural, institutional, and political dimensions. In EVOCA, researchers therefore paid special attention to the social dimensions of the diseases that were studied, for example analyzing how people respond to information about a disease, and people's motivations to adopt or reject disease prevention and control practices. In doing so, the EVOCA programme acknowledged that the social context in which an infectious disease hits and is dealt with matters equally. And indeed, time and again the researchers found that it is critical to recognize that diseases are part of larger socio-ecological systems in which many interdependencies exist that result in interactive effects between the social and ecological dimensions (Chepkwony, 2021; Damtew Assefa, 2020; McCampbell, 2021; Tafesse Gobena, 2020; see also table 1).

### Most infectious diseases are persistent

A particular feature of many infectious diseases is that they are persistent, which makes it almost impossible to wipe them out completely. This reality is a bitter pill to take and perhaps therefore often rejected. Take for example the Coronavirus,



*Table 1: Examples showing how actions by various individuals affect the collective impact of diseases which illustrates the existence of interdependencies. Adapted from: Galarza-Villamar, McCampbell, Leeuwis, & Cecchi, 2021, Tafesse Gobena, 2020 and Damtew Assefa, 2020.*

| Disease | What I do to prevent the disease | What others do instead | Effect of actions by others | Collective impact |
|---|---|---|---|---|
| Malaria | Drain standing water where mosquitos can breed | Not drain standing water from mosquito breeding places | Mosquitos breed nearby homesteads and become vectors of Plasmodium | Avoidable illness or death; further impoverishment of poor households and communities |
| Covid-19 | Stay home when showing flu-like symptoms, and getting tested with antigen or PCR test | Go out to the supermarket or visit friends while showing flu-like symptoms; Tested positive for Covid-19 later | Virus spreads via aerosols when coughing or sneezing, causing others to become infected | Avoidable illness and deaths; potential collapse of healthcare system; need for collective measures and (new) forms of law enforcements |
| Banana Xanthomonas Wilt | Remove banana male flowers in plantation, and disinfect cutting tools before working in neighbors' plantations | Leave infected banana on plantation without removing male flower. Use the same tools on all bananas without disinfection | BXW bacterium spreads within and between plantations via insects and tools | Decrease of local food security; Market shortages of banana; impoverishment of poor households and livelihood loss |
| Potato Bacterial Wilt | Practice crop rotation with non-solanaceous crops, use certified seed, disinfect farm tools, inspect potato fields regularly for disease symptoms, destroy diseased plants, and control host weeds. | Use infected seed, fail to disinfect farm tools, remove infected plants but leave them in the field instead of destroying them, and sell infected seed | Potato bacterial wilt spreads widely, threatening seed and ware potato production | Jeopardizes food and nutrition security, reduces farmers' income, and harms farmer livelihoods |
| Potato Late Blight | Apply fungicides, use disease resistant potato varieties, and eliminate volunteer potatoes. | Use susceptible potato varieties, do not applying fungicide or apply it at lower dose, and leave volunteer potatoes unremoved in crop fields | Potato late blight pressure increases in the production areas and devastates the crop | Jeopardizes food and nutrition security, reduces farmers' income, and harms farmer livelihoods |

while scientific studies have laid out that eradication of the virus is a pipe dream, some hold on to the belief that an elimination strategy is the way forward. A similar pattern is seen in how, for a long time, policy makers in Uganda and Rwanda approached BXW disease. For example, in Rwanda, the goal was to eradicate BXW entirely from the country. During annual large-scale interventions, involving support from the army, hundreds of hectares of banana plantations were uprooted entirely. But time and again it turned out to be a temporary fix, one escaping infected banana mat or disease pathogen would be enough to cause a new outbreak. Many scientists agree that containment and not eradication is the best way forward for infectious diseases for which there is no definite cure. How to do this? For example, by suppressing a disease pathogen. In EVOCA, this was found to be one of the best strategies to reduce disease occurrence and spreading, and it basically means reducing transmission of the disease as much as possible and bringing outbreak levels down to acceptable levels. In other words, the focus should be on the prevention rather than the control of outbreaks. Accepting that infectious diseases do not go away completely, however, they come with new challenges. Then, how do you contain a disease pathogen that returns as soon as you turn your back to it?

### *People require knowledge*

People require timely, accurate, and relevant biophysical and technical information about a disease and its dynamics to act in an appropriate way (Damtew Assefa, 2020; McCampbell, 2021; Tafesse Gobena, 2020). This includes information about, for example, the causes and transmission patterns of a disease, how it can be diagnosed in the field, and what practices are suitable to prevent and control it. While such information and knowledge inform people's practices (Damtew Assefa, 2020) they are in practice often lacking. This causes issues with collaboration and coordination between individuals when addressing socio-ecological problems, such as infectious diseases. EVOCA research showed that these issues especially occur under circumstances where there is a high cost attached to an individual's contribution to a common good (e.g. absence of a crop disease resulting in a good yield) in combination with a marginal or uncertain individual benefit (e.g. spraying against potato late blight is expensive while it is not certain if the chemical is effective to control the disease or if the farm faces an infection threat that planting season). African smallholder farmers are known to try to reduce their (economic) investments in crop production and disease management as much as possible with the aim to optimize their profits. They thereby knowingly or unknowingly increase the risk that disaster strikes: For example, the outbreak of BXW disease.

Results from an experimental game with Rwandan banana farmers showed that farmers trying to save money on disease prevention early in the game, would later have to invest much more in control or lose their banana crop all together. Worse, not only the individual farmer lost more, but so did their fellow players. In other words, one person's failure to contribute to the collective goal to prevent BXW disease caused harm to everyone (Galarza-Villamar, McCampbell, Galarza-Villamar, et al., 2021).



*Community training on agricultural practices in Rwanda (Photo: ITA Rwanda).*

Can farmers be made aware of interdependencies and the need to collaborate? Research results from Ethiopia showed that a combination of experiential and social learning is most suitable to teach people about the potato diseases. This meant that farmers obtained both biophysical and technical knowledge about potato diseases and learned about interdependencies in the potato production system and the necessity to work together when preventing and controlling disease outbreaks.

### *Collective action in disease management*

Depending on the specific disease, transmission patterns, and contextual conditions there are usually numerous disease management options available. These options can be packaged into strategies. Simply put two categories of strategies can be identified; (1) strategies that concentrate on individual responsibility and individual actions, and (2) strategies that focus on collective responsibility and collective actions.

***Collective action among interdependent farmers and coordination among all stakeholders in an innovation ecosystem are both needed***

*Photo: Shiferaw Gobena*

About the two strategy options, researchers of the EVOCA programme found that collective strategies are more successful in the long run. For example, a study in East Africa showed that a collective strategy gave the best results for managing BXW. Whenever farmers worked together, they were able to reduce the presence of BXW more than when each of them focused on their individual farm (Blomme et al., 2019)"type":"article-journal","volume":"118"},"uris":["www.mendeley.com/documents/?uuid=35a61971-c949-3d8c-b658-b20b3536d548"]}],"-mendeley":{"formattedCitation":"(Blomme et al., 2019. Similarly, in EVOCA it was found that collective action among interdependent and coordination among all stakeholders in an innovation ecosystem are both needed. In other words, collective action within stakeholder groups (e.g. farmers or seed producers working together to prevent potato bacterial wilt) is needed as well as among stakeholder groups (e.g. farmers, seed producers, and extension agents developing a shared strategy for disease prevention). Unfortunately, EVOCA's Rwandan and Ethiopian case studies showed that in real-life farmers do not work together when it comes to prevention and control of crop diseases but focus on their own farm or do nothing (Damtew Assefa, 2020; McCampbell, 2021; Tafesse Gobena, 2020). Instead, responses to disease infection are often uncoordinated and focus on short-term solutions (Damtew Assefa, 2020) which makes the outcomes of disease containment strategies less sustainable (Murindahabi, 2020).



### *Engaging citizens in disease monitoring and research*

Collective action strategies may include citizen science approaches. These approaches can provide insight in the spatial and temporal variation of disease risks (Murindahabi, 2020) while the involvement of local people in decision-making about disease prevention and control strategies facilitates successful implementation and local support and participation. In Rwanda, researchers tested a citizen science approach to evaluate if and how local people could be engaged in the monitoring of and research on mosquito density and malaria risks. Their findings gave interesting insights in what motivates people to participate in a disease prevention programme. Initially, people's motivation to participate were the opportunities to learn about malaria in the broadest sense, and to contribute to disease control. But over time, recognition and acknowledgement of people's engagement and contributions became new motivational factors that were important for continued participation (Asingizwe, 2020). Beyond attention for people's motivations and preferences, the results of the citizen science project pointed out that it is critical to consider possible barriers to the use of disease control measures (idem).

### *The role of communication and deliberation*

EVOCA's case studies additionally provided both proof and new hypotheses about the influence of communication interventions on collective action and social learning. It turns out that expert advisory services and provision of relevant technical and social information need to be supported by deliberation processes.

***Farmers who could talk, discuss, and reach an agreement about a disease management strategy perform better***

Experimental research work in Ethiopia with potato farmers and in Rwanda with banana farmers contributed scientific understanding about how (digital) communication interventions may have both positive and negative effects for individual and collective action and performance, depending on the design of the intervention (Damtew Assefa, 2020; McCampbell, 2021; Tafesse Gobena, 2020). These interventions may additionally positively contribute to social learning among farmers when they provide space for knowledge exchange and deliberation (Damtew Assefa, 2020; Tafesse Gobena, 2020). For example, in Rwanda different experimental treatments were used to see if communication and an opportunity to strategize disease management would help the farmers to perform better in disease management. Sometimes farmers were allowed to talk and deliberate about the best strategy before starting the game, or mid-way the experiment. A control group was not allowed to talk. The result? Farmers who could talk, discuss, and reach an agreement about a strategy performed better, both individually and collectively. Yet, there was a caveat: communication only helped if the farmers had some epidemiologic and technological knowledge about the disease. However, in the absence of such knowledge, or presence of 'fake knowledge', performance

*Malaria trap in a bedroom of a citizen science volunteer in Rwanda (Photo: M. Murindahabi).*

dropped. The findings are in line with research on trust in science and the role of knowledge during the Covid-19 pandemic, which similarly stress the importance of accessible, trustable, and consistent information in times of high uncertainty during which people are sometimes asked to adhere to drastic measures[1].

## References


Asingizwe, D. (2020). *Citizen science for malaria control in Rwanda: Engagement, motivation and behaviour change.* Wageningen University.

Blomme, G., Ocimati, W., Sivirihauma, C., Lusenge, V., Bumba, M., & Ntamwira, J. (2019). Controlling Xanthomonas wilt of banana: Influence of collective application, frequency of application, and social factors on the effectiveness of the Single Diseased Stem Removal technique in Democratic Republic of Congo. *Crop Protection, 118*, 79-88.

Chepkwony, R. K. (2021). *Connecting divergent worlds: Social and ecological factros influence tick-borne diseases in tropical drylands.* Wageningen University.

Damtew Assefa, E. (2020). *Social-institutional problem dimensions of late blight and bacterial wilt of potato in Ethiopia.* Wageningen University.

Galarza-Villamar, J. A., McCampbell, M., Galarza-Villamar, A., Leeuwis, C., Cecchi, F., & Galarza-Rodrigo, J. (2021). A Public Bad Game Method to Study Dynamics in Socio-Ecological Systems (Part II): Results of Testing Musa-Game in Rwanda and Adding Emergence and Spatiality to the Analysis. *Sustainability 2021, 13(16)*, 9353.


1 Sciencemag: https://science.sciencemag.org/content/371/6532/893/tab-article-info
The Atlantic: https://www.theatlantic.com/ideas/archive/2021/02/how-public-health-messaging-backfired/618147



## Recommendations for policy and action

### Focus on collective action rather than individual action

What is best for the individual in the short-term (e.g., lowest investment in disease management) appears to seldomly lead to an outcome that is best for the collective, especially in the longer-term. Intervention designs should promote collective action.

### Involve local actors in decision-making

Involve local people in the decision-making about and design of a disease monitoring programme and consider their preferences. This facilitates successful implementation, and retention of local support for and participation in monitoring programmes.

### Pay attention to capacity and knowledge

Knowledge matters. People who lack the right information cannot take well-informed decisions. People need to be given opportunities to obtain timely, accurate, and relevant information and knowledge e.g., through face-to-face training or apps.

### Create spaces for deliberation and learning

Communicating, deliberating, and building collective strategies reduces disease risks for everyone. Interventions should thus focus on both social and experiential learning, while also creating spaces for exchange within and between stakeholder groups.

### Acknowledge the existence of power relations and hierarchies

Acknowledge that power relations and hierarchies within and between stakeholder groups exist. Aim to take this into account when designing disease prevention and control strategies. Ensure that everyone's voice counts, including that of minorities, least powerful, and dissentients.

### Invest in disease containment early on

Eradication of infectious diseases is often impossible. Early investment in disease containment can thus provide a better return on investment. Focus on continuous and sustainable prevention of disease outbreaks, to guarantee acceptable outbreak levels.

### Consider development of institutional arrangements

This may be in the form of monitoring and sanctioning systems to stimulate social learning and collective action. Such arrangements then need to be built into disease monitoring programmes.

Galarza-Villamar, J. A., McCampbell, M., Leeuwis, C., & Cecchi, F. (2021). Adding Emergence and Spatiality to a Public Bad Game for Studying Dynamics in Socio-Ecological Systems (Part I): The Design of Musa-Game for Integrative Analysis of Collective Action in Banana Disease Management. *Sustainability. 2021, 13(16)*, 9370.

McCampbell, M. (2021). *More than what meets the eye: Factors and processes that shape the design and use of digital agricultural advisory and decision support in Africa.* Wageningen University.

Murindahabi, M. M. (2020). *Citizen science for malaria vector control in Rwanda.* Wageningen University.

Tafesse Gobena, S. (2020). *Understanding and managing bacterial wilt and late blight of potato in ethiopia: Combining an innovation systems approach and a collective action perspective.* Wageningen University.



## About the author

Mariette McCampbell (PhD) works as a researcher and independent consultant. She has extensive experience in East and Central Africa, and India. Mariette's recent research focused on digital innovations in agriculture, especially agricultural advisory services. Her PhD research on digitalization and Banana Xanthomonas Wilt was one of the six EVOCA case studies.

## Acknowledgements

This policy brief and the findings presented in it are based on research under the programme titled 'Responsible life-science innovations for development in the digital age: EVOCA' which has been financially supported by the Wageningen University Interdisciplinary Research and Education Fund (INREF). We acknowledge the support of the partner organizations who made the case studies possible: Rwanda University School of Medicine's College of Medicine and Health Sciences, Forum for Agricultural Research in Africa (FARA), Foundation for Sustainable Development (FSD), Grameen foundation, Integrated Water & Agricultural Development Ghana LTD. (IWAD), International Institute of Tropical Agriculture (IITA), International Livestock Research Institute (ILRI), International Potato Institute (CIP), Kumasi Institute of Technology, Energy and Environment (KITE), MDF West Africa, Technical Centre for Agricultural and Rural Cooperation (CTA), and Veterinary Services Kenya.

## Colophon

Text: Mariette McCampbell
Design: Luc Dinnissen (studio ds)

WAGENINGEN UNIVERSITY & RESEARCH

IITA Transforming African Agriculture

CGIAR

CIP INTERNATIONAL POTATO CENTER A CGIAR RESEARCH CENTER