Passive Sampling Devices Enable Capacity Building and Characterization of Bioavailable Pesticide Mixtures along the Niger, Senegal and Bani Rivers of Africa

Kim A. Anderson†, Dogo Seck*, Kevin A. Hobbie†, Anna Ndiaye Traore*, Melissa A. McCartney†, Adama Ndaye*, Norman D. Forsberg†, Theodore A. Haight†, and Gregory J. Sower†
* Centre Régional de Recherches en Ecotoxicologie et de Sécurité Environnementale (CERES), Km 15, Route de Rufisque --- BP 3300 Dakar (Sénégal)
Environmental and Molecular Toxicology, Oregon State University, Corvallis, OR

OSU Oregon State University

Food Safety & Environmental Stewardship

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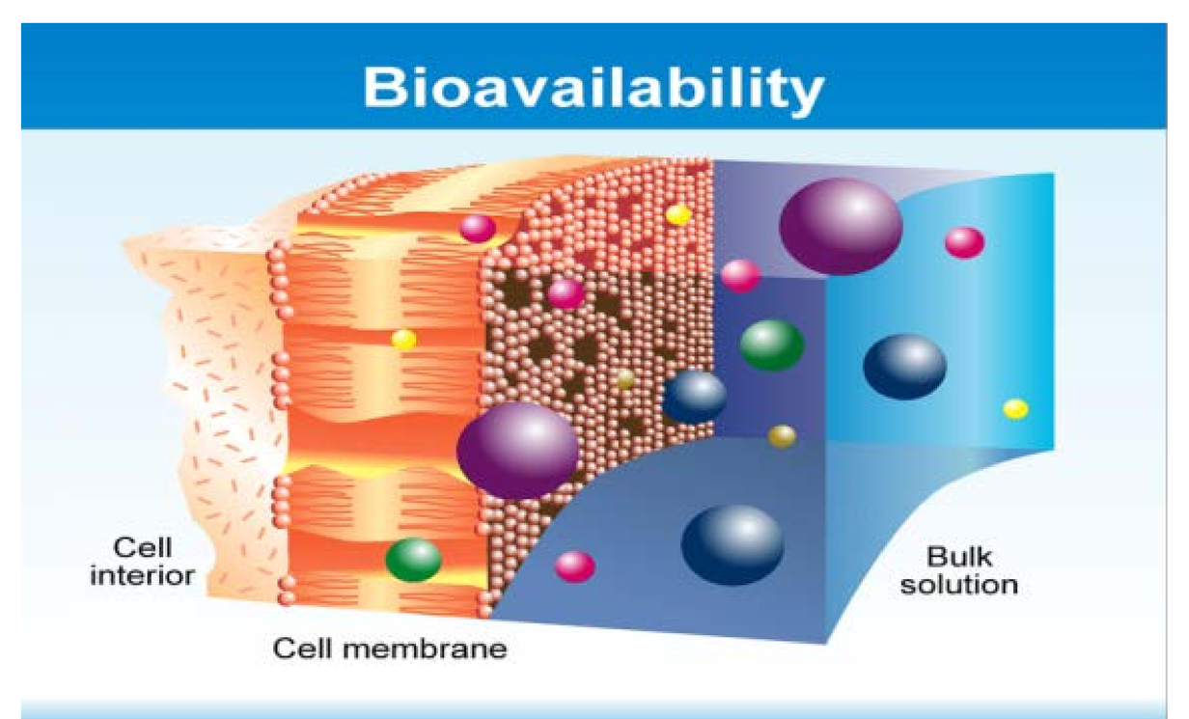
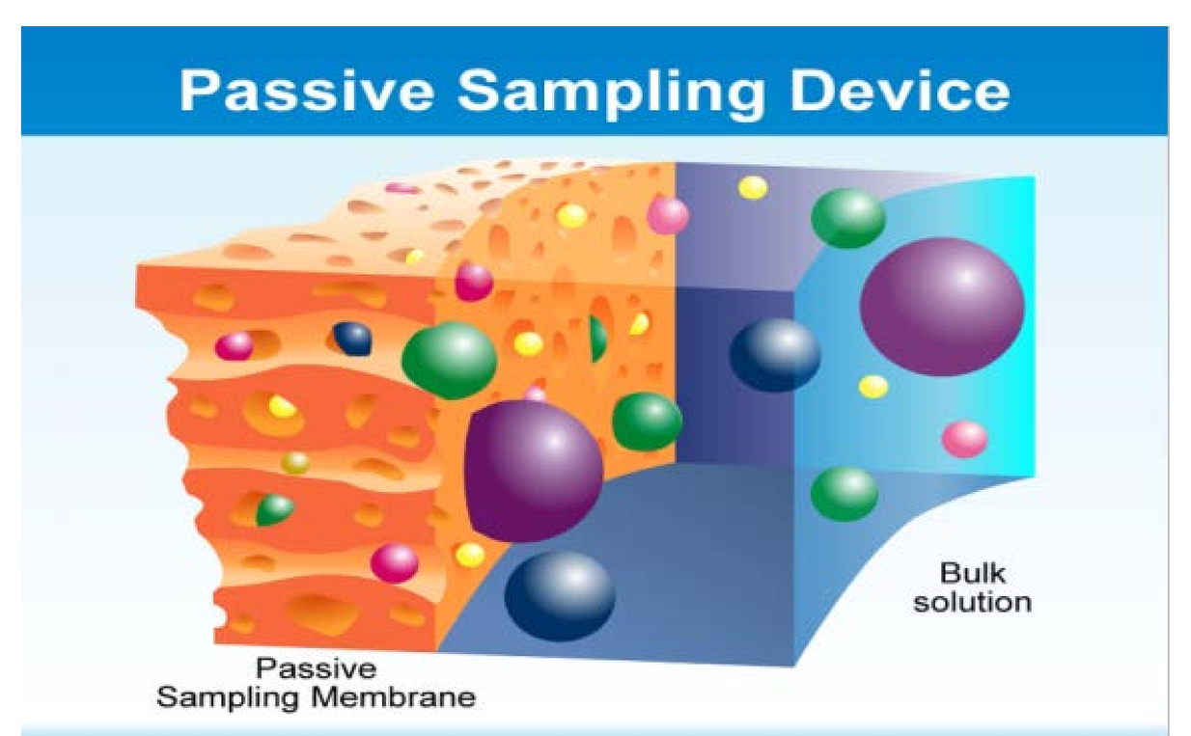
fses.oregonstate.edu

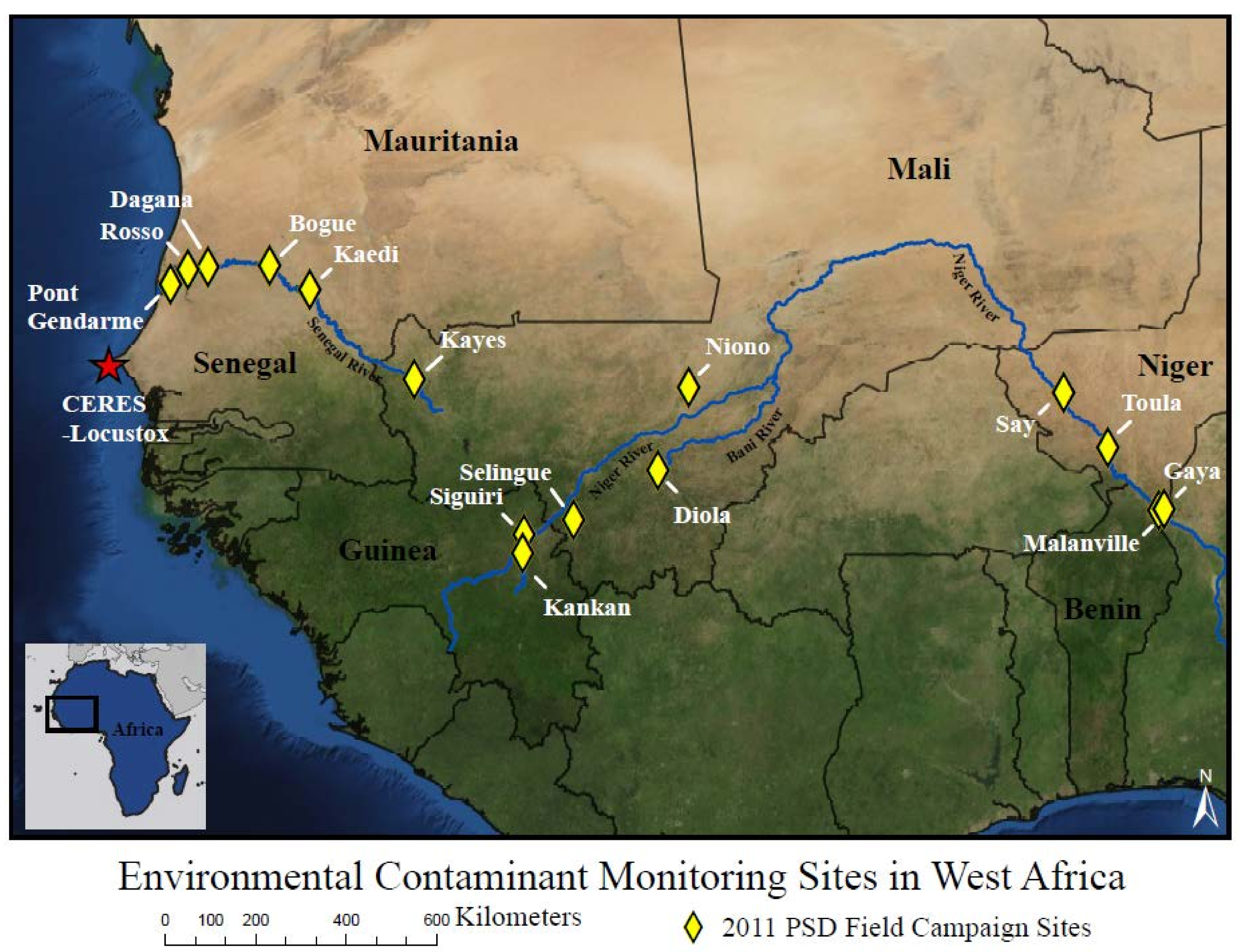
It is difficult to assess pollution in remote areas of less developed regions due to limited availability of energy, equipment, technology, trained personnel, and other key resources. Passive sampling devices (PSDs) are technologically simple analytical tools that sequester and concentrate bioavailable organic contaminants from the environment. Scientists from Oregon State University and the Centre Régional de Recherches en Ecotoxicologie et de Sécurité Environnementale (CERES) in Senegal developed a partnership to build capacity at CERES and to develop a pesticide monitoring project using PSDs. The partnership and dynamic process developed is applicable to equivalent capacity building programs. The project culminated in a field and laboratory study where paired PSD samples were simultaneously analyzed in African and US laboratories with quality control evaluation and traceability. The joint study included sampling from 63 sites across 6 western Africa countries, generating a 9,000 data point pesticide database with virtual access to all study participants.

Passive Sampler

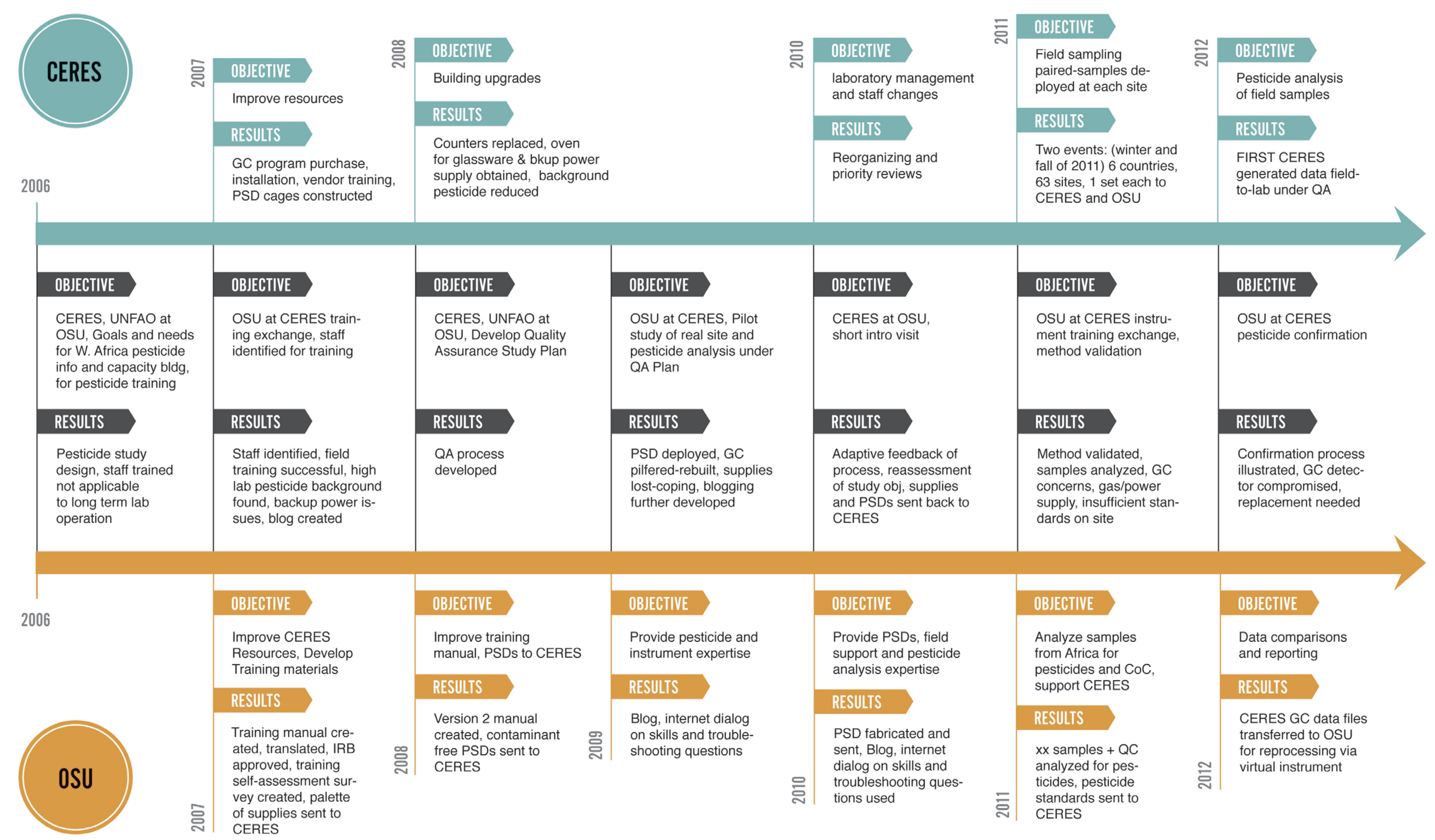
Passive sampler polymer sequesters hydrophobic organic compounds much like an organism's lipid layer.



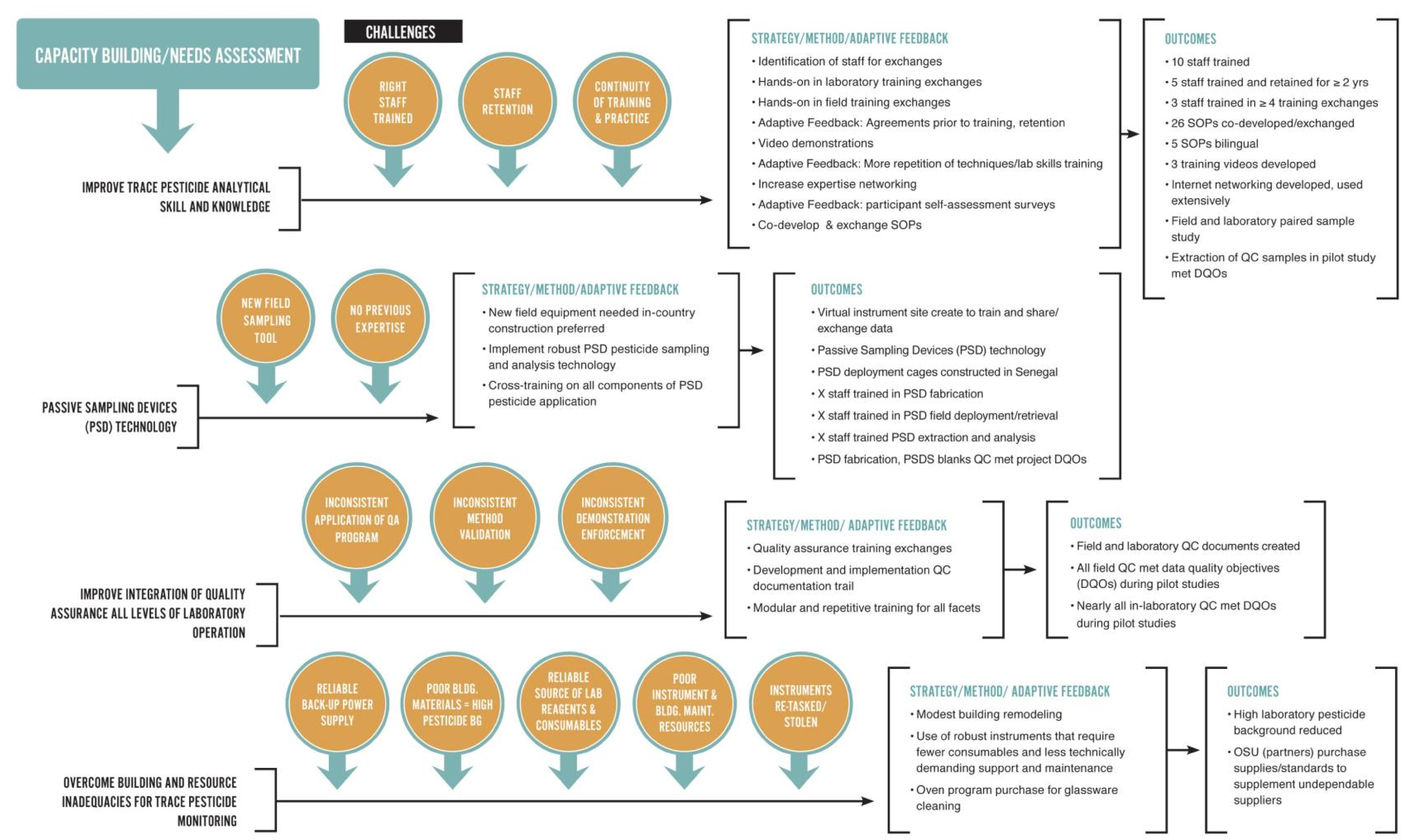




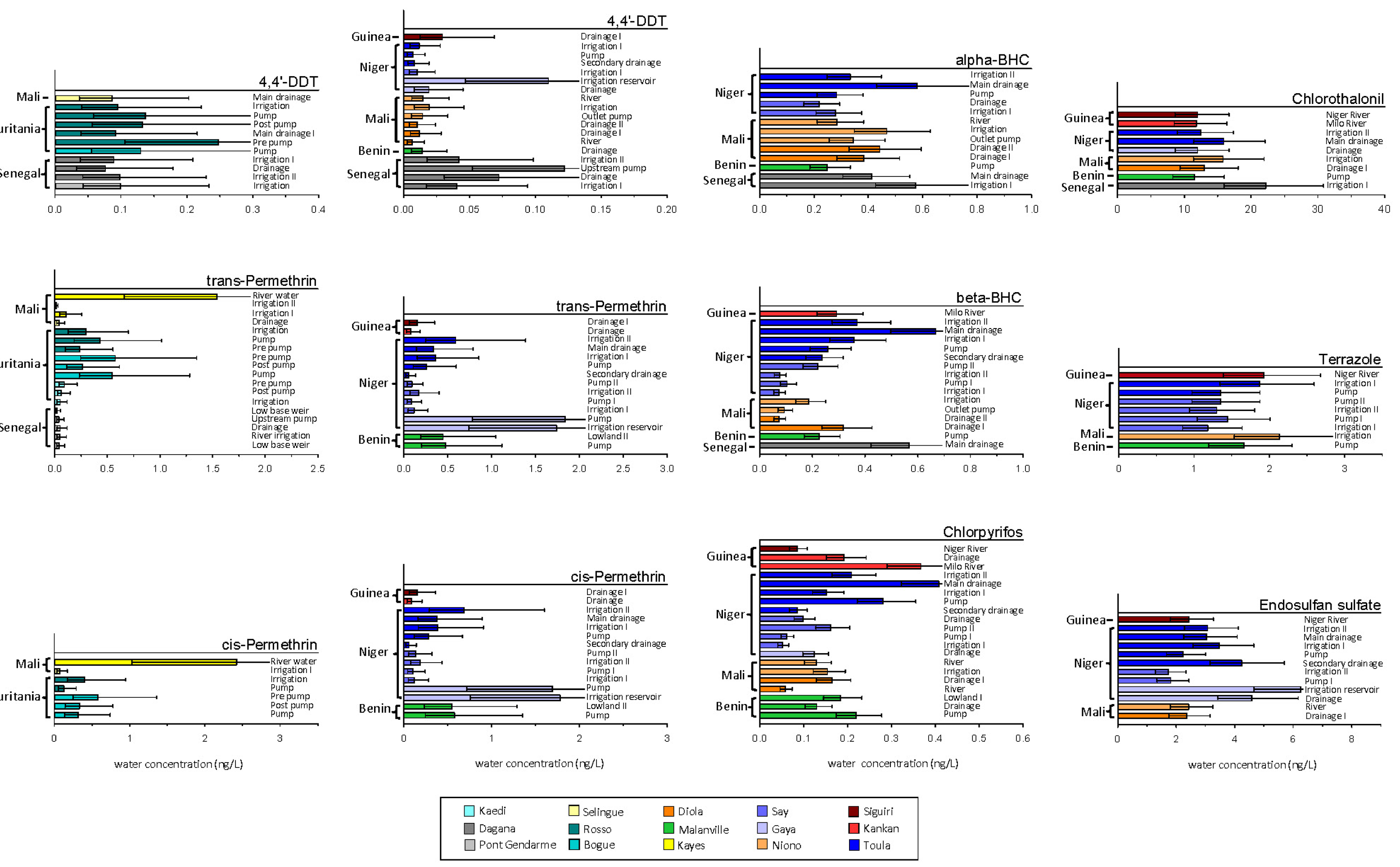
Environmental Contaminant Monitoring Sites in West Africa



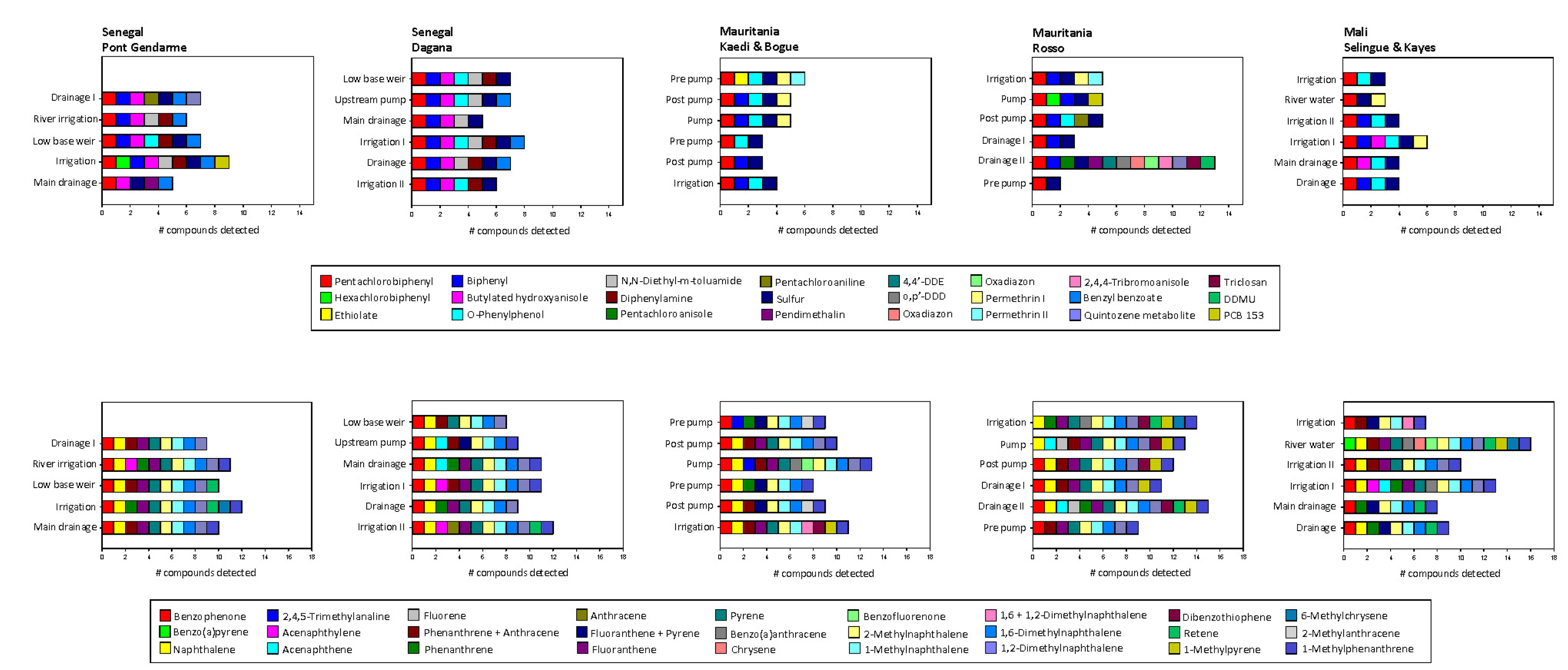
Timeline of objectives and results of the capacity building events: delineates the joint and individual activities by CERES and OSU. The project culminated in a field and laboratory study where paired PSD samples were simultaneously analyzed in African and US laboratories with quality control evaluation and traceability. The joint study included sampling from 63 sites across 6 West African countries, generating a 9,000 data point pesticide database with virtual access to all study participants.



Capacity building needs, companion challenges, strategies, methods and outcomes: summarizes the needs assessment, recognizes previous and associated challenges, the approach and adaptive feedback, and the final outcomes.



Select bioavailable (C_{free}) pesticide concentrations in: Mali, Mauritania, Senegal, Guinea, Niger and Benin with individual locations/sites indicated by color code see legend. Sites not included in the graphs were below the level of quantitation for the contaminant.



Detection of chemical of concern identified in samples using mass spectral de-convolution and identification in PSD extracts from Africa. Panels A and B are the number of chemicals of concern that were identified in samples from each site. The colors of the blocks indicate which chemicals were identified in the sample. Panel (A) are PCBs and pesticides and panel (B) are PAHs and substituted PAHs.

Conclusion

Passive sampling devices proved to be an effective tool for measuring C_{free} organic contaminants, including pesticides, in the water of agricultural systems in western Africa. This study provides important baseline information for assessing potential exposure and risk to a wide range of chemicals of concern and the preliminary results indicate a need for further monitoring and risk assessment. Pesticides considered to be obsolete were detected throughout the study area, suggesting that these chemicals are either currently being used and/or there are legacy sources in the area. Additionally, our data demonstrate that emerging contaminants from other anthropogenic sources and personal care products are also present. Due to the difficulty of resolving small differences in pesticides' concentrations, however, these data should be interpreted with caution because apparent inconsistencies or trends have yet to be assessed with a rigorous statistical approach.

Acknowledgements

This project was supported in part by award numbers #1420 funding provided to FAO from UNEP and GEF funded by the International Waters Focal Area, and partly by the Chemistry Facility Core; from the National Institute of Environmental Health Sciences (NIEHS) from NIEHS P42 ES016465 and the Environmental Health Science Center from NIEHS P30 ES000210, OSU's Food Safety and Environmental Stewardship Program and a public subvention of the Senegalese Ministry of agriculture to CERES. The content is solely the responsibility of the authors and does not necessarily represent the official views of the United Nations Food and Agriculture Organization, National Institute of Environmental Health Sciences or the National Institutes of Health. We appreciate valuable assistance from Lucas Quarles, Marie Ndao, Dr. Wendy Hillwalker, Dr. Makhfousse Sarr, Dr. Papa Sam Gueye, Baba Gadji, Amanda Ackerman, Cheikh Mouhamed El Fadel Toure, Jennifer Przybyla, Kristin Kamerud, Jorge Padilla, Nathan Rooney, Mike Barton and Dr. Sarah E. Allan. Additionally, we are grateful for analytic expertise from Glenn Wilson and insightful conversation with Mike Robson.