Consensus Statement and Summary for
Wetland Endangered Species Assessment of Herbicides Workshop

March 14, 2021

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The workshop with more than 30 invited participants was held October 26-28, 2020 with a series of presentations (mainly technical) and discussions. The invited participants represented multiple stakeholder groups including government agencies, academia, industry, grower associations, and NGOs. The workshop website with a list of participants and short bios, the workshop schedule, abstracts for presentations, presentations and discussion notes is located at: https://ag.purdue.edu/arge/Pages/wetlands.aspx.

Wetland Endangered Species Assessment (ESA) is a critical component of regulatory ecological risk assessment of pesticides in the United States. US EPA uses a screening level assessment approach as a basis in making pesticide registration decisions relevant to wetland endangered plant risk. While the screening level assessment informs a potential risk, refined levels of assessment are used to adequately characterize the risk for decision making. The workshop brought together experts to explore the state-of-the-knowledge with respect to the runoff exposure pathway to wetland habitat with a focus on channelized runoff and modeling tools to simulate pesticide exposure in wetlands. Furthermore, available conservation programs and best management practices (BMPs) were examined as runoff and erosion mitigation measures to be incorporated in risk assessment and/or risk management.

Based on the workshop presentations and participant discussions, the following areas emerged as opportunities that should be considered and pursued: (1) improvement in models; (2) support of modeling assessments with data; (3) leveraging advances in data science.

Improving models

Hydrologic/water quality models have rapidly evolved in the past 25 years and will continue to evolve to better represent processes incorporated in the models as well as represent processes that had not yet been considered. The spatial and temporal scales that models can be applied to have also expanded over this period. Advancements in these areas are likely to continue in coming years.

Models for regulatory purposes have also advanced over this period, but the gap between models evolving for research and other applications in recent years and those being developed and used for regulatory purposes has grown for various reasons. Therefore, opportunities exist to advance models used for regulatory purposes by leveraging advances that have occurred in recent years in research and other hydrologic/water quality models.

The harmonization of model development and use across federal agencies should be explored. A simple starting point would be increased communication across agencies to share efforts related to model development, model application, and data that may support model use. Federal agencies such as USDA use various hydrologic/water quality models in meeting their mission. These models range from field- to watershed-scale models with a range of capabilities, many of which are suitable in whole or in part for EPA assessments. These models are particularly suited for assessment at increased tier levels. Examples of models used by USDA in conducting their operations or projects include APEX, WEPP, and SWAT. The USGS is a source of data used in some EPA modeling assessments, and in many cases, USGS scientists have used hydrologic/water quality models with these data to explore various questions, and thus their insight with respect to models would benefit EPA.

Specific recommendations with regard to Plant Assessment Tool (PAT) and higher tiered assessment models

EPA presented a recently developed higher tier exposure model, PAT, for non-target terrestrial plant regulatory assessment. Workshop participants made the following specific recommendations on the PAT model.

Subsurface drainage is prevalent in much of the Midwestern crop production region to facilitate crop production. These systems alter the hydrologic cycle and transport of constituents from agricultural fields to offsite locations. To better account for Midwestern crop production systems, higher tiered models should consider subsurface drainage. Various hydrologic/water quality models representing subsurface drainage are available and widely used for a range of applications, including SWAT and APEX among others. Currently, the PAT model does not account for subsurface drainage.

Numerous types of wetlands exist with diverse conditions including hydrology. For example, a common wetland type in many glaciated areas of the Midwestern crop production area are potholes that have subsurface drainage and function differently than wetlands defined in PAT. The PAT model makes greatly simplified assumptions about wetlands and how they function. Improvements in representing the broad types of common wetlands, as well as improvements in key processes in these wetlands, are needed and could be accounted for in PAT's wetland representations.

Hydrologic processes such as channel flow are important in the transport of constituents to offsite locations and could be better represented in PAT assessments in higher tiers. Models such as SWAT (Soil and Water Assessment Tool) and WEPP (Water Erosion Prediction Project) developed by the USDA are widely used nationally and globally for a range of applications. The science within these models is well documented and has been widely validated and published. Processes within these models should be explored for use in higher tiered EPA assessment models.

More general recommendations

A range of conservation or best management practices are commonly employed by agricultural producers. Higher tiered modeling assessments need to be able to represent a range of such practices. Representation of practices within hydrologic/water quality models, including those used in higher tiered assessments, remains an active area of research and development and often presents challenges in accounting for the practices, as representations are often model specific. EPA would benefit from working closely with researchers that are focused on simulation of conservation practices within hydrologic/water quality models to develop clear approaches to practice representation in higher tiered EPA modeling assessments.

The EPA would likely benefit from an approach in developing higher tiered models for regulatory application that is more inclusive of the modeling community throughout model development. The modeling community would be able to provide focused expertise that would be beneficial. Such an approach would also allow EPA modeling needs in higher tiered models to evolve quickly and not become locked in.

The complexity of assembling data and conducting model simulations results in significant expertise being required to use models. Developing regulatory models in a way that reduces the expertise and skills required to run such models would facilitate their use within regulatory settings as it would remove local decision making that is often required at present and allow broader application of the models.

Advances in describing uncertainty associated with model predictions has made significant progress in recent decades. The incorporation of approaches that provide information on uncertainty in modeling associated with assessments for regulatory purposes could potentially provide useful information to those using models in regulatory decision-making. The EPA may wish to explore such capabilities in higher tiered modeling assessments.

Supporting modeling assessments with data

The availability of both spatial (e.g. land use, soil maps) and temporal data (e.g. water flow, water quality parameters at a sampling location) has grown significantly in recent decades and is likely to grow even more rapidly in coming decades. Discovering and accessing data that have recently been developed or that are being developed can be difficult. This is especially the case with regional and local data sets that may be valuable for conducting higher tiered modeling assessments.

The USDA (including ARS and NRCS) has a range of data sets that may be useful for various tiers of EPA assessments. Some of these data sets are currently used by the EPA in their modeling assessments. Other data sets, such as those regarding cropping management practices and conservation practices, are not utilized at all or as effectively as they might be by EPA. Higher tiered assessments in particular would benefit from use of data sets on cropping management

practices and conservation practices. Data regarding conservation practices remains a significant data limitation that would benefit from additional efforts.

Areas within EPA beyond the division responsible for pesticide risk assessments have data sets that would be highly useful in conducting pesticide risk assessments. A wetlands and drainage area to wetlands data set that is nearing completion within EPA was described at the workshop. The national spatial data set contains data about wetlands including the drainage area to each wetland computed from digital elevation data. Other data sets useful for pesticide risk assessment likely exist or are being developed within the agency.

Other agencies such as the US Fish and Wildlife Service also have data sets that would be useful in higher tier pesticide assessments that include the National Wetlands Inventory. These data would be highly useful in higher tiered assessments allowing differences in wetland types to be considered. Such differences in wetlands may require specific modeling of wetland processes. The modeling scenarios for higher tiered assessments may also need to vary by wetland type given differences in drainage area and characteristics of various wetland types.

Identifying water quality data useful with models and other assessments can be a challenge given that local and regional water quality data collection efforts are often conducted by a range of state and local groups. These data can be useful in calibrating and validating models used in pesticide risk assessments to assess model performance.

The modeling community, including within EPA, would benefit from the creation of an online data portal/repository that those working in wetlands could utilize for data sets and tools. This portal/repository would not be limited to crop protection product assessments and would be open access (for example, Wiki or GitHub) so that it becomes a living resource. There are many diverse data sets and modeling tools as noted earlier that are difficult to discover and often you need to be fully aware or work within a specific area to learn about them. This is limiting the advancement of our understanding and knowledge building. It also contributes to silos by skills, goals, or backgrounds (modelers vs. experimentalists or industry vs. academia) and has the potential to impede model developmental opportunities.

Leveraging advances in data sciences

Advances in data sciences and related areas have accelerated in recent years and are impacting many areas of work as well as our daily lives. Recent advances and those on the horizon have the potential to significantly impact the future of modeling and regulatory assessments. Areas that have experienced rapid change with more change likely in the near future include Artificial Intelligence, Machine Learning, big data, supercomputing, high performance computing, cloud-based computing and storage, and Internet of Things, among others.

These advances provide large data sets, data that have never been available at the spatial and temporal scales now available, and the promise of even more data sets in the future from both proximal and remote sensing. These technologies may also have the potential to confirm the presence and efficacy of location specific conservation practices.

Data science advances also have the potential to greatly alter the approaches to modeling and regulatory assessment. Large data sets combined with machine learning and artificial intelligence can potentially improve or even replace current models. Models can potentially be run for large areas as well as automated for use for small areas providing an opportunity for location specific approaches to regulation of pesticides in the future. Further, location specific models can account for conservation practices in place and that might be implemented to provide appropriate levels of protection.

A future workshop that explores data science and its role in modeling, including for regulatory applications, should be considered given the potential of this area to impact modeling and regulatory assessment.

Researchers and model developers have been building process-based models with increasing levels of complexity, but these highly detailed tools are being created and used by highly skilled modelers making them inaccessible to a large segment of stakeholders. An opportunity exists for creating "next generation" models where modeling, computing, and analyses are done in the cloud helping researchers, decision-makers, producers work together towards a more inclusive view of project development. Such approaches would utilize machine learning, data flows from sensor arrays, big data sets, and models, and thus have the potential to transform the way that modeling is done. An effort such as this would need a team to connect all of these pieces (modelers, data analytics experts, those who build and use sensors, those using traditional monitoring approaches, extension, industry, government, and others). A review paper could be developed to describe a vision for this opportunity and encourage collaboration in pursuing the vision.

Concluding thoughts

The workshop identified several opportunities for follow-up workshops that build on scientific information sharing that occurred leading up to, during, and post workshop. Participants were in 100% agreement at the conclusion of the workshop that follow-up meetings should be held and that they would welcome an invitation to participate in subsequent workshops. Participants indicated a strong interest and willingness to continue collaborations around wetland modeling with the multi-stakeholder community assembled for this workshop. The participants identified the range of expertise, range of backgrounds and experiences, willingness to collaborate, and diverse organizations of their fellow participants as strengths that made the workshop valuable and therefore appealing to build upon. The specific workshop that should follow next will depend on the most pressing needs of the community as several potential follow-up workshop topic areas were identified as outlined in the report above.