

Project: How does urban context influences functional traits across taxonomic groups?

UrBioNet Patterns & Traits Workshop Background

UrBioNet is a global network for urban biodiversity research and practice funded through the US National Science Foundation's Research Coordination Network (RCN) program (NSF RCN: DEB# 1354676/1355151). Two of the activities that UrBioNet is funded to support are 1) the development of a global database of urban biodiversity studies, and 2) a total of three regional workshops, each based around a distinct theme that aligns with their Working Groups. This project relates to the regional workshop held by the Patterns, Drivers and Traits Working Group. Further information about UrBioNet can be found at: <http://urbionet.weebly.com/>

The UrBioNet Patterns & Traits Workshop was held at Rutgers University, New Brunswick, NJ, USA from 27-31 March 2017. Planning for the workshop began in 2015, initially as a small collection of UrBioNet Steering Committee members, but gradually extended to include other participants as the concepts developed. Ultimately, the Workshop was attended by 22 urban ecologists from a range of countries and career stages, who worked on a diverse range of taxonomic groups.

Research Aim

The workshop focused on the following research question: *Does the urban context (of a site) influence the functional traits of multiple taxonomic assemblages in consistent ways?* In preparation for addressing this question at the workshop, the core group of participants undertook a systematic review of the published urban biodiversity literature to identify studies that were published in the English-language scientific literature and met all of the following criteria: 1) community level data; 2) collected at multiple sites; 3) across one or multiple urban areas. Further information about this process can be found in Supplemental Material- Systematic Literature Search Methodology¹.

The results from systematic literature review were used to identify a set of focal taxonomic groups where there were sufficient studies available for a meaningful synthesis to be undertaken. Currently the focal taxonomic groups are: amphibians, bats, bees, carabid beetles, butterflies, birds, mammals and plants, but additional groups may be added to this current project if sufficient information can be collected in time to include them in the final analysis. The coordinators for the different taxa then began sending out emails to authors of the studies identified through the systematic literature review, asking if they would be willing to provide their datasets for this project, and inviting the them to contribute more broadly to this project.

The datasets we are compiling are community level information collected at multiple sites across an urban landscape. We accept datasets regardless of whether or not they include non-urban site data. Our definition

¹ Still being compiled as at 3 August 2017.

of "urban" is very general as we are quantifying land-cover measures in a systematic way as part of the analysis (see below for details). Therefore, we are happy to accept any dataset that includes biodiversity data from landscapes where there is a collection of built infrastructure present.

Data Requirements

For each dataset we require the following information: 1) species by site information provided in list format, 2) a sites x environment table that includes the latitude and longitude of each site in decimal degrees using the WGS 1984 datum, and 3) species by trait information compiled for the five functional trait groups (Table 1)². The geographic coordinates will be used to populate environmental variables related to the properties of each site from a set of existing global spatial datasets (Table 2). These environmental variables will be calculated for two buffer distances (200 m and 1.0 km) around each site using the measures identified in Table 3.

Table 1. Description of the five functional trait groups

| Functional Trait Group | Justification for including this group in the analysis |
|--|---|
| Body Size <i>Basic trait describing organism</i> | Body size has been used in many studies as it often plays a key role in many allometric relationships, including species responses to urbanization. It is related to many functions ranging from resource acquisition to tolerance to abiotic conditions. Morphological trait describing the size or mass of the organism (e.g., body length, body width, body mass, and body volume; for plants: tree, bush, herb). |
| Feeding Trait <i>Trait describing the species' daily requirement</i> | Indication of where the species sit in the trophic hierarchy and/or whether they have specialist requirements for acquisition of nutrients. It informs about 'who eats what or whom / what'. Food type, upon which species feed. In some animals feeding guild could be different between adults and larvae. For plants it could be the nutrient acquisition strategy. |
| Reproduction Trait <i>Trait describing the species' ability to produce the next generation</i> | Indication of ability of the organism to produce the next generation of offspring. eg, Average clutch size, roosting requirements, sociality. |
| Dispersal Trait <i>Trait describing a species' requirement over a time period longer than one day</i> | Indication of the ability of the organism to navigate the landscape. Trait proxy describing the dispersal distance and speed (e.g., long vs short distances, Ability to fly, wing morphology, wing area, wing load, seed type). |
| Taxa Specific Trait <i>An ecologically relevant trait specific to each taxonomic group</i> | Individual taxonomic groups may be more strongly influenced by an alternative trait that is not captured using the four functional trait groups considered in this project. The Ecologically Relevant trait is consistent within a taxonomic group, but is not necessarily closely aligned between taxonomic groups. |

² See accompanying document "Instructions for entering spatially explicit census data"

Table 2. Global datasets used to quantify environmental variables for each site.

| Variable | Dataset |
|-------------------|--|
| Tree canopy cover | Growing season percent tree canopy cover (vegetation taller than 5 m) for the year 2000 at 30 m spatial resolution (Hansen <i>et al.</i> , 2013) http://earthenginepartners.appspot.com/science-2013-global-forest/download_v1.2.html |
| Built-up presence | Built-up presence for the year 2000 at 38 m spatial resolution using the Global Human Settlement (GHS) images analytics framework http://ghsl.jrc.ec.europa.eu/ghs_bu_s1.php |

Table 3. Metrics calculated within two circular regions (radius = 0.2 and 1 km) centered on each site.

| Metric | Source |
|---|---|
| Percent tree canopy cover and built-up presence | |
| Maximum patch size of tree canopy cover and built-up presence | |
| Aggregation of tree canopy cover and built-up presence | Aggregation index (He <i>et al.</i> , 2000) |

Analysis Methods

To enable comparisons across taxa, we identified five general functional trait groups that would allow for a meaningful discussion in the context of multiple taxa. These Trait groups are presented in Table 3, and explained more fully in instructions for entering data.

To examine the relative strength of the relationship between the urban context (Tables 2 and 3), and the five different categories of functional traits (Table 1) we will conduct a separate fourth-corner analysis (Brown *et al.* 2014) for each individual taxonomic group, using city as an explanatory variable.

To look for consistencies across multiple taxa we will compare the output values from these separate fourth-corner analyses across our different taxonomic groups.

Project Management Arrangements

For this project, we are working to achieve a balance between providing dataset owners with sufficient opportunities to make a substantial contribution and qualify for authorship on the paper, without compromising the ability to keep the project moving forward in an effective and efficient manner. To this end, we have developed a "tracks and signals" system, which has similarities to handling manuscripts submitted to a journal for review. Essentially the Project controller is the Editor in Chief, the Taxa Coordinators are Associate Editors, and the participants in the mailing groups are the Reviewers. However, that is where the similarity ends. Under the proposed system each UrBioNet discussion group is responsible for developing a single agreed response to send back to the Project Control Group. This is to minimize the number of competing drafts that the control group need to consider, and will ensure that the project maintains the momentum.

This system relies heavily on both editorial control at the level of the coordinating committee (to streamline decisions), and bottom-up support from the participants in the discussion groups related to each taxa (to give everyone the opportunities to substantially contribute to the manuscript in a meaningful way). We are not

currently aware of any other collaborations where a model such as this has been used, but we believe it has potential to really advance collaborations across large groups. Since this is essentially a trial of the system, participants are encouraged to send in suggestions for potential improvements. It may not be possible to implement them in the current project, but they could provide useful feedback for future projects. Feedback can be provided via the Taxa Coordinators (Table 4).

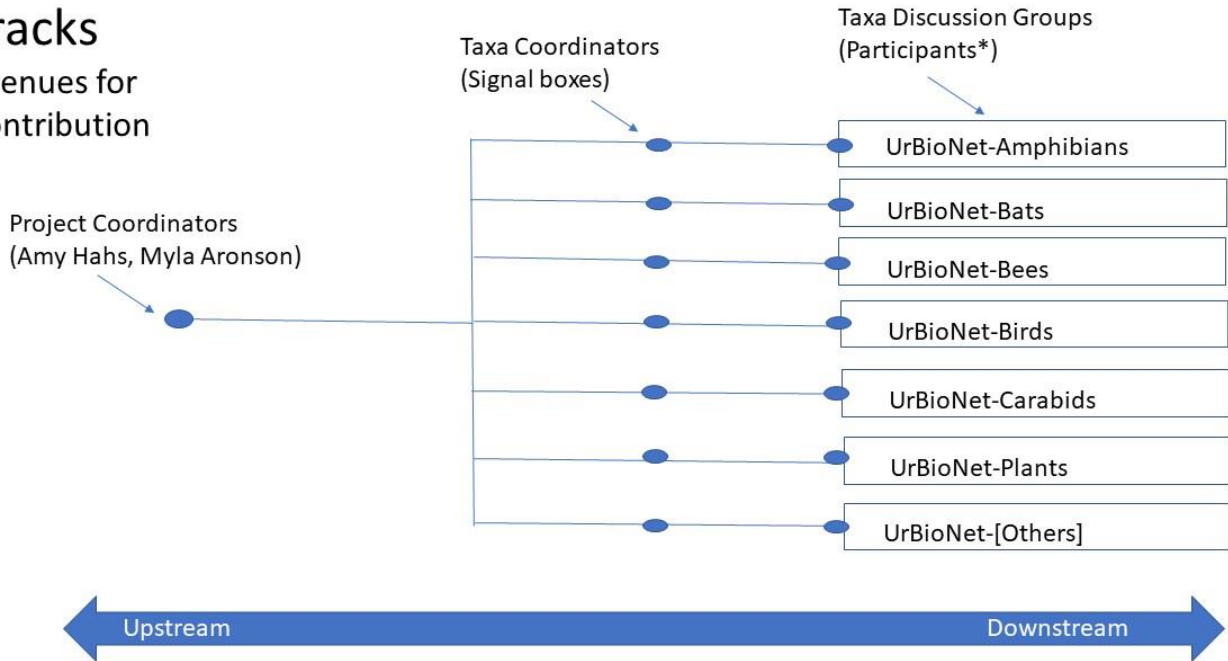
Table 4. List of Taxa Coordinators and taxa email addresses. General inquiries can be addressed to Dr Amy Hahs (hahsa@unimelb.edu.au) and Dr Myla Aronson (Myla.Aronson@rutgers.edu).

| Taxa | Coordinators |
|---|---|
| Amphibians/Reptiles | Dr Adriana Herrera Montes, Dr Ian MacGregor Fors |
| Bats urbionet.bats@gmail.com | Dr Caragh Threlfall, Dr Kirsten Jung, Ela Carpenter |
| Bees urbionet.bees@gmail.com | Dr Scott MacIvor, Dr Caragh Threlfall, Dr Nick Williams |
| Birds urbionet.birds@gmail.com | Dr Madhusudan Katti, Dr Ian MacGregor Fors, Dr Chris Lepczyk, Dr Chris Trisos |
| Butterflies urbionet.butterflies@gmail.com | Dr Scott MacIvor, Julie Goodness |
| Carabids urbionet.carabids@gmail.com | Dr Marco Moretti, Dr Johan Kotze |
| Mammals urbionet.mammals@gmail.com | Dr Chris Lepczyk, Dr Kirsten Jung |
| Plants urbionet.plants@gmail.com | Dr Sonja Knapp, Dr Nick Williams, Dr Myla Aronson, Dr Amy Hahs, Max Piana, Julie Goodness |

Figure 1. Tracks: streams through which participants can provide meaningful feedback and suggestions

Tracks

Avenues for Contribution



* Participants can belong to more than one Taxa Discussion Group

Fig 2. Signals: Timeline of stages during the project where participants are encouraged to contribute

Signals

Timing of Contribution



Qualifying for Authorship

UrBioNet's Authorship Policy includes the criteria that a person must make a substantial contribution to a manuscript before they can be listed as an Author. In the context of this project, a substantial contribution consists of: 1) providing clean, standardized, analysis-ready datasets where the participants have spent the time preparing it so it is ready to include in the analysis; AND 2) by providing intellectual contributions to the project through discussions at any one of stages outlined in the Project Management Section (See Figures 1 and 2). We prefer that one member of multi-author research groups be the point person and subsequent author on the project paper, but if this is not possible, each person must meet the authorship requirements.

To help with managing the sensitive issue of Authorship, we will populate a current list of authors starting after the circulation of the preliminary results. This list will be circulated with and updated after each subsequent step. We are taking this approach as it more explicitly communicates where the conditions of authorship have been met, and where additional contributions are required. Please note: the criteria for authorship are a minimum, and participants are welcome to continue contributing even after that condition has been met but here are no expectations around this.

The final version of the paper will be circulated to all participants prior to submission. At this stage the opportunity to provide a substantial contribution to the project has ended. The purpose of sharing the final version is to allow everyone to see the manuscript before it is submitted so that they can check their affiliations are correct, and verify relevant persons or funding bodies are included in the Acknowledgements.

References

- Hansen, M.C., Potapov, P.V., Moore, R., Hancher, M., Turubanova, S.A., Tyukavina, A., Thau, D., Stehman, S.V., Goetz, S.J., Loveland, T.R., Kommareddy, A., Egorov, A., Chini, L., Justice, C.O. & Townshend, J.R.G. (2013) High-resolution global maps of 21st-Century forest cover change. *Science*, **342**, 850.
- He, H., DeZonia, B. & Mladenoff, D. (2000) An aggregation index (AI) to quantify spatial patterns of landscapes. *Landscape Ecology*, **15**, 591-601.

Frequently Asked Questions

What happens if you have a suitable dataset for a non-focal taxonomic group?

This workshop is simply the beginning of projects that can be supported by UrBioNet. Where such datasets exist, the authors are encouraged to contribute their data to the UrBioNet database so that it can be easily identified and included in possible future analyses and projects.

Who will be able to see my data?

For the purpose and duration of the workshop project described in this document, the datasets will be stored in a dropbox folder which can only be accessed by the workshop coordinating group and their assistants. This access will be permitted for the duration of the project, or for the duration of the individual's involvement in the project, depending on which scenario occurs first.

In all cases, where a dataset has been contributed to this project a metadata file for that dataset will be entered into the UrBioNet Urban Biodiversity Database. This metadata simply captures general information related to the type of data available, details about the identity of the data owner(s), and access level at which the data are available.

At the completion of the project, the compiled trait databases will automatically be migrated to the UrBioNet Urban Biodiversity Database on the MOspace platform. Access will be provided via the process outlined in the UrBioNet Data Agreement Policy.

The species x site and site x locations datasets will also be migrated to the UrBioNet Urban Biodiversity Database on the MOspace platform if the authors have given explicit permission to do so. For any datasets where the owners do not want their datasets migrated, a copy will be kept in a safe location by the UrBioNet Chief Investigators until the time embargo on records has been met, at which point they will be destroyed. Further information about the UrBioNet Urban Biodiversity Database is available at:

<http://urbionet.weebly.com/> and here: <https://mospace.umsystem.edu/xmlui/handle/10355/46235>

My datasets contain sensitive information. How will this information be protected if I chose to contribute to this project?

This project is analyzing information at the global scale, and will not be producing any maps or information where site coordinates can be inferred beyond the scale of the location of the city they are contained within. However, in the move towards open data platforms in publishing, we may be required to include a version of the full dataset as a condition of publication. In this case, we will be able to invoke the mechanisms in which sensitive information is not made publicly available.

In terms of internal handling of this sensitive information, there are two avenues through which authors can contribute datasets to this project, whilst ensuring sensitive information remains protected. In both cases, the authors would provide us with the first two data matrices (species x site_ID, species x functional trait) in an analysis-ready format through the standard data sharing process (details proved elsewhere). However, the site_ID x geographic coordinates would either be: a) submitted directly to a single member of the team who would extract the relevant environmental information from the coordinates, and destroy them after the environmental variables have been compiled; or b) kept by the dataset owner who would agree to populate the environmental variables table using the methods sent through by the UrBioNet workshop coordinator and provide this non-geographically identifiable data back to the project.

The most appropriate course of action will be determined on a case-by-case basis. If your datasets fall into this category, please contact the Project Coordinators: Dr Amy Hahs (hahsa@unimelb.edu.au); Dr Myla Aronson (Myla.Aronson@rutgers.edu)

Further Information

See the UrBioNet webpage (<http://urbionet.weebly.com/>) for the answers to further FAQs. If you would like further information please use the following suggestions as a guide.

For questions related to UrBioNet, the UrBioNet database, or the Research Coordination Network grant this project has been funded by, please contact the Co-Directors of UrBioNet: Dr Charles Nilon (NilonC@missouri.edu); Dr Myla Aronson (Myla.Aronson@rutgers.edu)

For questions related to the workshop, data templates, opportunities for participation/substantial contribution, etc., please contact the Project Coordinators: Dr Amy Hahs (hahsa@unimelb.edu.au); Dr Myla Aronson (Myla.Aronson@rutgers.edu)

For questions related to a particular taxa, please contact the Taxa Coordinator or the person who was your initial point of contact for this project.