

# Computational Workshops to Facilitate Implementation of Statistics in Scientific Research

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## Problem & Purpose of Project

- Research practices in the environmental sciences have changed because of growth in computational power and the volume and variety of available data.
- In this rapidly changing computational landscape, calls from environmental scientists have surfaced to re-evaluate how curricula can “better prepare current and future generations of environmental researchers” (Green et al., 2005; Hampton et al., 2016).
- Over the last twenty years, Statistics preparation in the environmental sciences has become vital.
  - Hence, Statistics courses have been incorporated into these graduate programs, across the nation.
- However, computing has become more important in the field of Statistics than even five years ago, such that a “just enough” level of understanding of computing is not adequate (Nolan & Temple Lang, 2010).

## Computational Expectations of Faculty Members

- Montana State University faculty members from environmental science fields are being interviewed regarding the computational skills they believe are necessary for Master’s and Doctoral students to perform research in their field.
- Computational expectations varied across fields of research, however, most faculty emphasized students’ ability to implement
  - conditional statements
  - data manipulation
  - writing functions
  - looping & vectorization
- “I think the expectations have gone up in order of magnitude in the last decade. We have very high expectations of statistics and very low expectations in computation.”
- “I kind of assume that the Stats department is teaching our students R coding.”

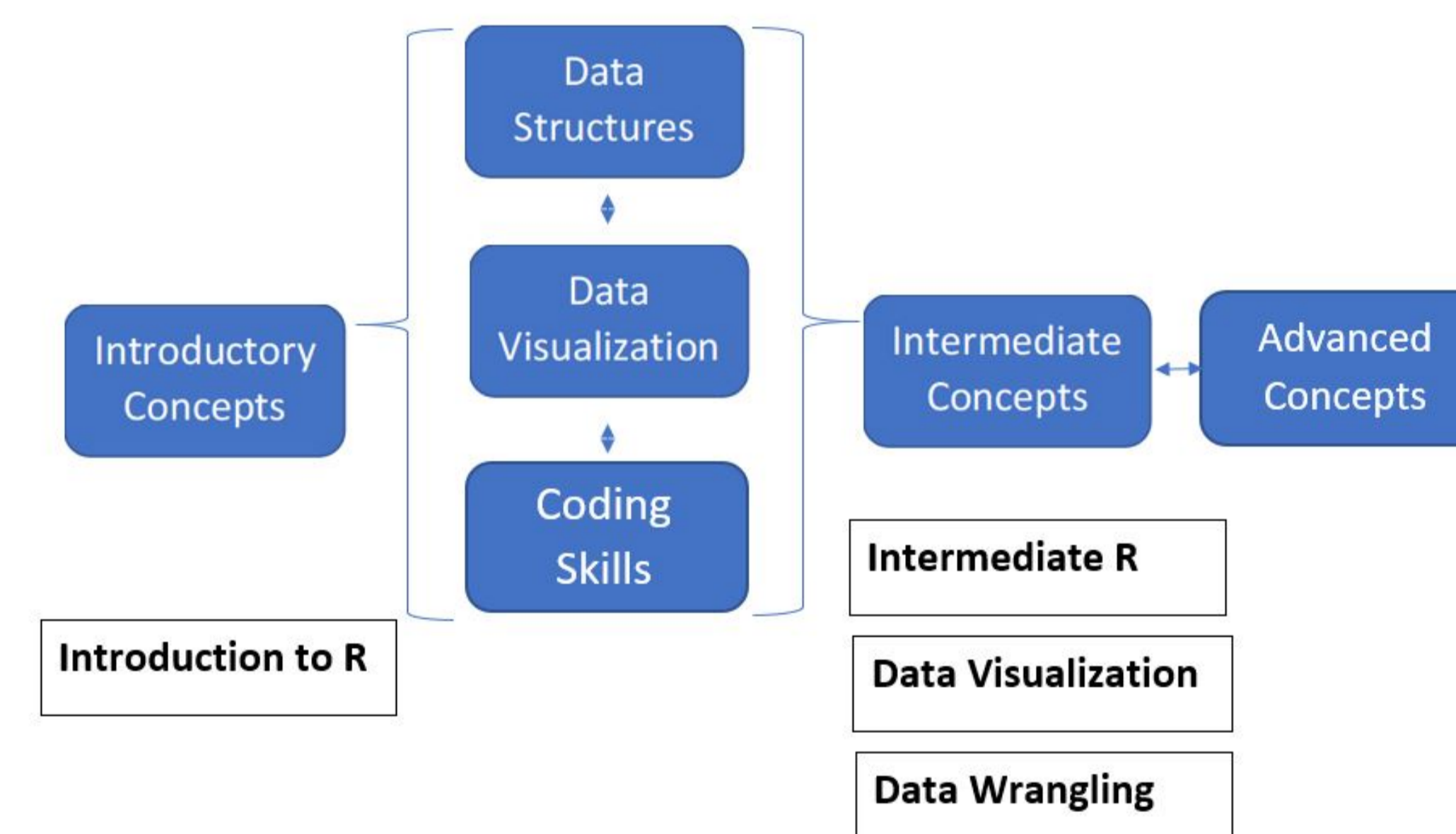
## Statistical Computing Workshops

### Workshop Environment

- Workshops are presented in a technology enhanced classroom, promoting the active learning of participants.
- The RStudio Cloud is used to disseminate workshop materials to participants.
- Each workshop is lead by one instructor and two trained helpers.

### Workshop Content

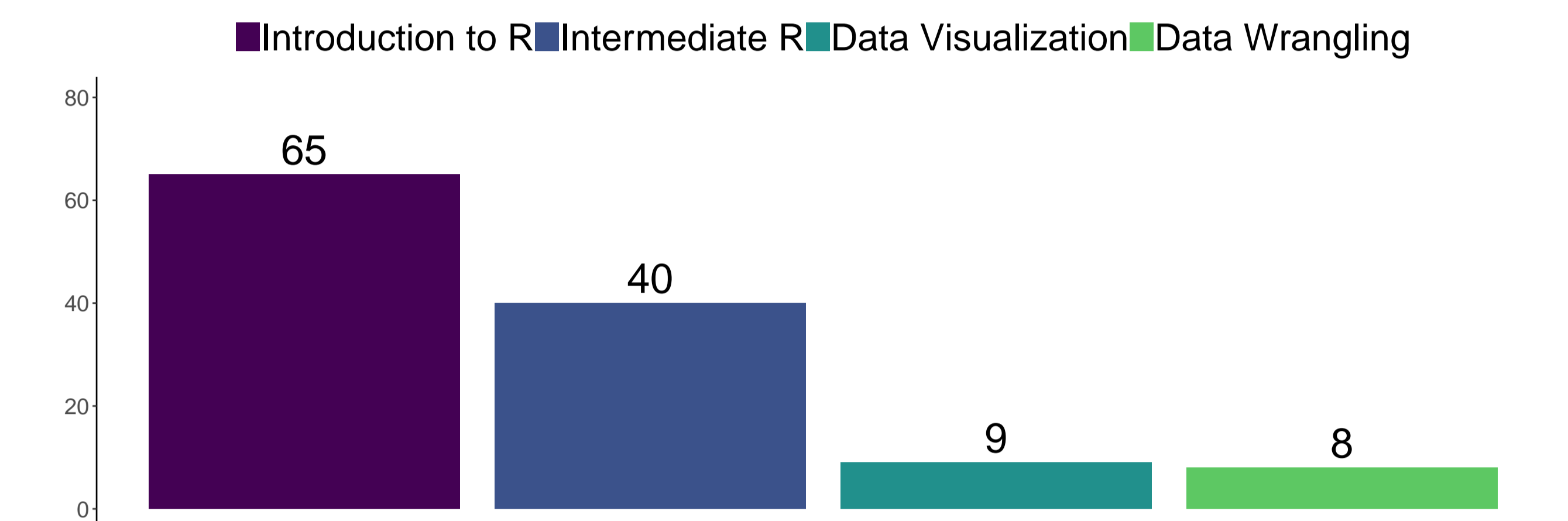
- The content of these workshops has been informed by
  - interviews with faculty members in the environmental sciences
  - collection of research code from environmental science graduate students



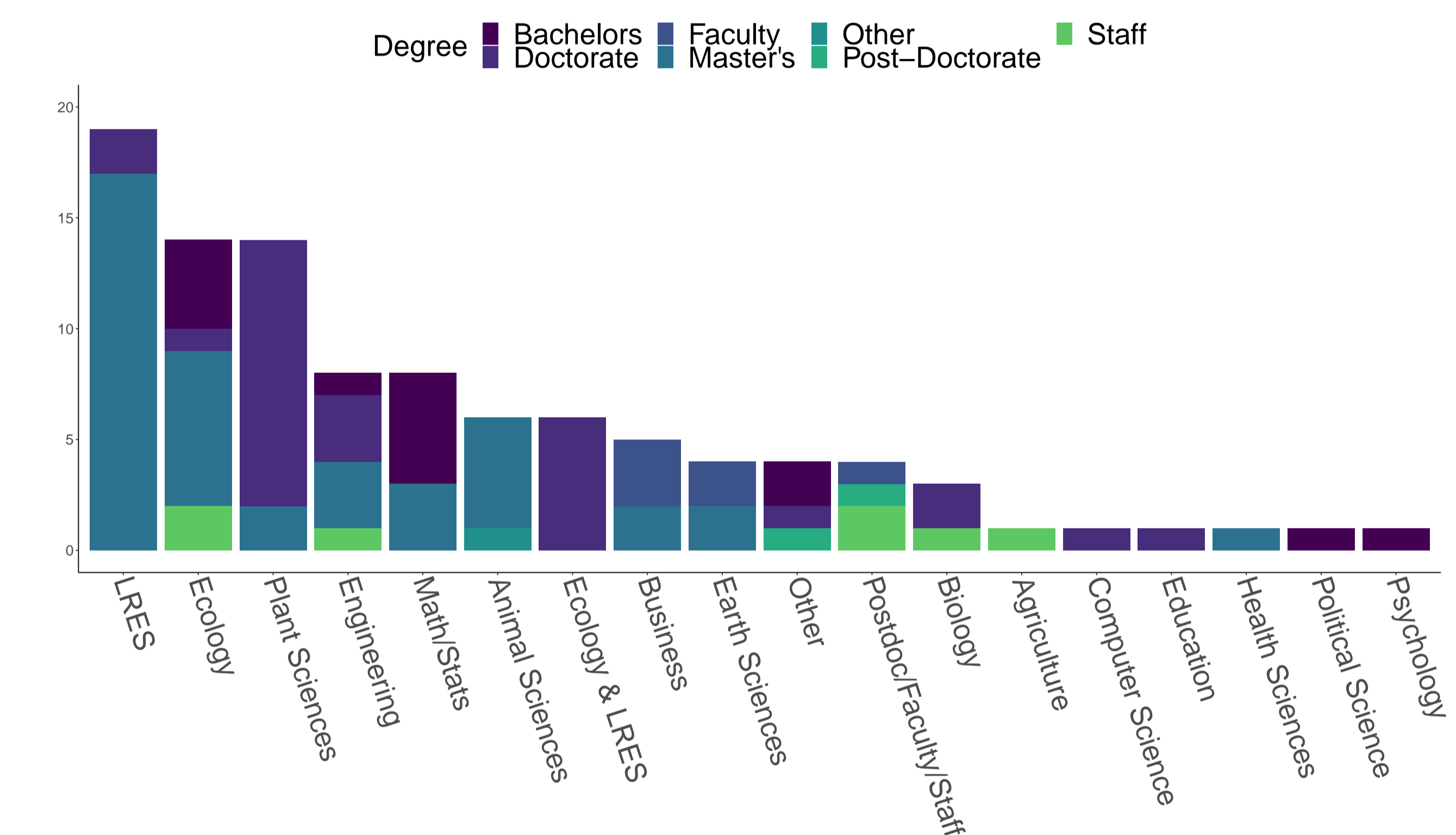
- **Introduction to R:** objects in R, working directories and environments, basics of inspecting, extracting, manipulating, summarizing and visualizing data
- **Intermediate R:** relational and logical operators, conditional statements, looping, and user-defined functions
- **Data Wrangling in R:** data manipulation with `dplyr` and data organization with `tidyr`
- **Data Visualization in R:** grammar of graphics with `ggplot2`

## Workshop Participants

### Workshop Attendance



### Departments and Degrees of Participants



### Reasons for Attending

Reason Attended	Participants
Research assistance	58
Coursework assistance	35
Received an email or saw a flier	25
Refresh or update skills	16
Department/Professor recommended	13
Preparation for graduate school	12
Professional Development	7
Adviser recommended	6
Expand Skills	6