POP-UP WETLAND HABITATS

Benefit Migrating Birds and Farmers

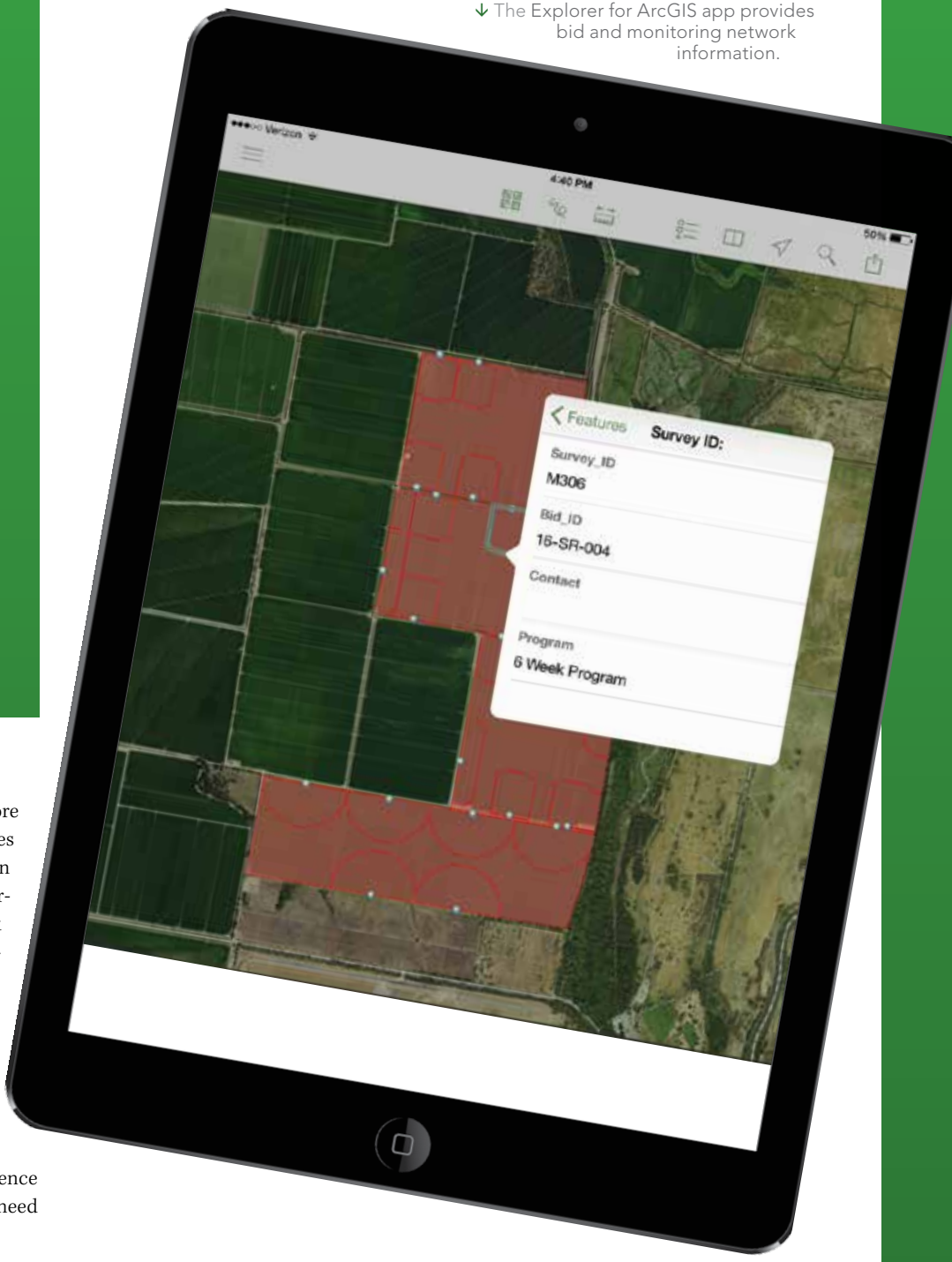
By Christopher J. McColl, Conservation Analyst; Katie Andrews; Mark Reynolds; and Gregory H. Golet, The Nature Conservancy

In response to the decline of wetland habitats for migrating and wintering water birds in California, The Nature Conservancy (TNC), an international conservation organization, has developed a program called BirdReturns. The program creates "pop-up" wetland habitat where and when birds need them most by enlisting farmers to flood their fields at specific times.

habitat with market tools to pay farmers to generate habitat.

How It Works

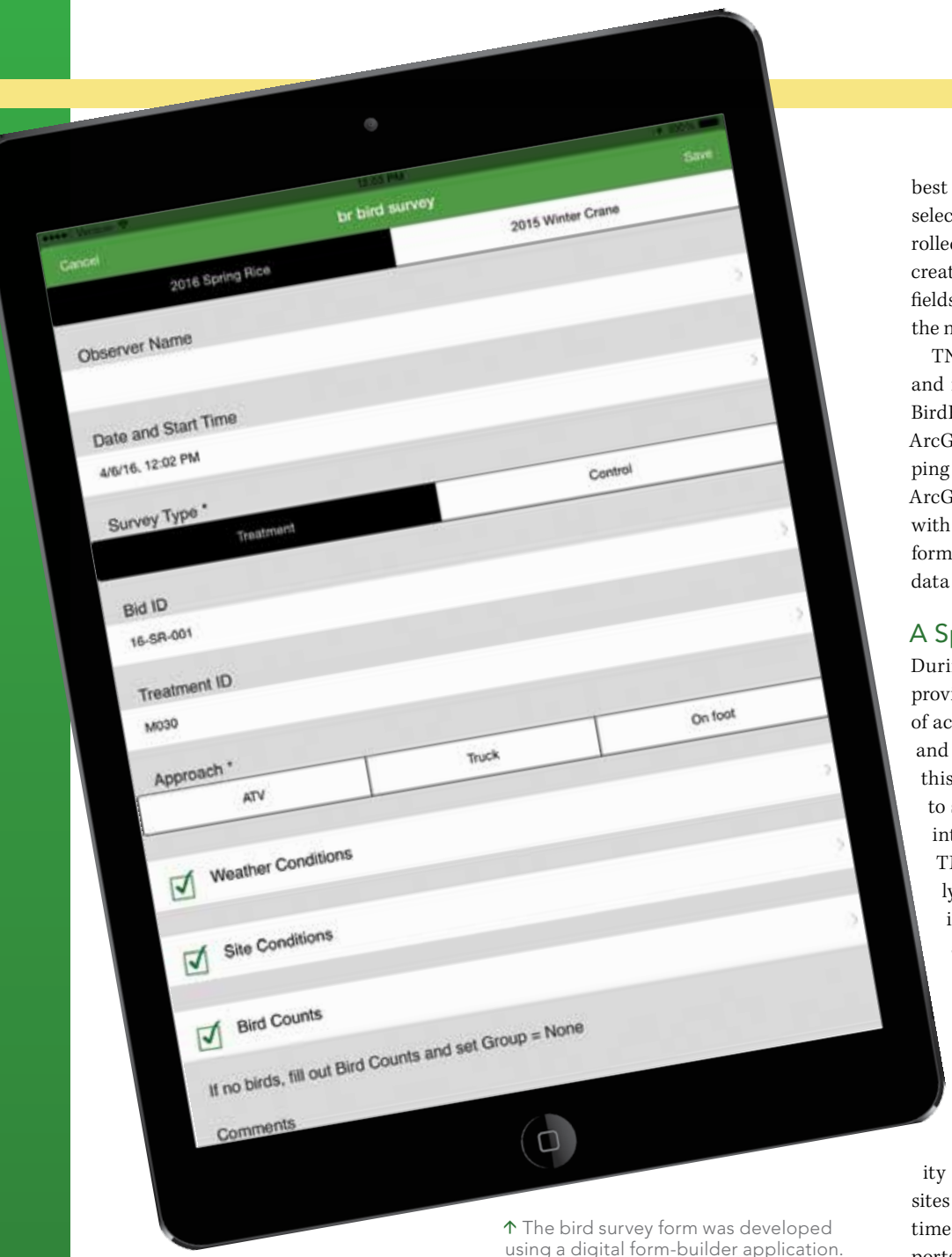
Working in partnership with Cornell Lab of Ornithology and Point Blue Conservation Science, TNC uses predictive models of water bird occurrence and abundance and surface water availability to target times and places predicted to have high bird occurrences and abundances but lack habitat availability. Since piloting the program in the spring of 2014, BirdReturns has targeted shallow water habitat for shorebirds from February to March and from mid-August to October. These are time periods when



↓ The Explorer for ArcGIS app provides bid and monitoring network information.

California's Central Valley has lost more than 90 percent of the four million acres of wetlands that at one time supported an estimated 40 million wintering waterfowl. Birds now depend on a patchwork of refuges, protected areas, and farmland for their habitat needs.

Protected area strategies, such as buying land that could be restored to wetlands in perpetuity, can be prohibitively expensive, and the number of willing sellers is limited. BirdReturns is a complementary approach that combines precision science to pinpoint where and when birds need



↑ The bird survey form was developed using a digital form-builder application.

predicted shorebird needs are great but appropriate habitats may be in short supply.

Farmers are invited to participate in a reverse auction. They submit bids for the cost of providing habitat in two-week increments in spring or fall. TNC processes bids by geolocating each field and evaluating bids based on price per acre, predicted bird occurrence model scores, distance from refuges, protected areas and other bids, and other factors. The goal of the evaluation process is to provide the greatest value of high-quality habitat for the least cost. The bids with the best conservation return on investment are selected. Farmers with winning bids are enrolled in a program that will pay them if they create the proposed habitat by flooding their fields. TNC monitors the habitat created and the number of birds that use the habitat.

TNC relies on a suite of geospatial, cloud, and mobile technologies to implement the BirdReturns program efficiently—from ArcGIS Online for collaborative web mapping and program design to the Explorer for ArcGIS app, which supports the field teams with an interactive mobile map, to digital forms that are used by field teams to collect data on mobile devices.

A Spatially Explicit Auction

During the reverse auction, bidding farmers provide information detailing the number of acres, cost per acre, location of the fields, and how long they would like to provide this habitat. An online web map is used to support the transfer of bid information into a GIS data layer using ArcGIS Online. TNC staff are able to work simultaneously, digitizing bid locations and verifying information provided by BirdReturns auction participants. The selection process is supported by analyzing various ecological metrics to identify the most competitive bids.

Metrics include distance to high-probability surface water, predicted mean abundance of shorebird species, predicted mean probability of shorebird species, probability of bid sites having surface water present during time-specific periods, and distance to airports. The bid GIS data layer is then used as a zonal layer to extract the various ecological metrics reflective of each bid location. The summary statistics are used to generate relative indexes to support the ranking of each bid.

The BirdReturns team reviews the bid locations via an ArcGIS Online web map application in conjunction with the ranked ecological metrics. The ArcGIS Online web map application provides an efficient method for team members, who are located in remote offices, to collaboratively review the data in real time and visually assess the field characteristics using Esri's online

imagery. They can quickly make determinations concerning which bids should be prioritized for further assessment.

Monitoring Response and Compliance

Once auction bids are selected, it is critical to determine the response of the shorebird populations to the newly created habitat. Which species are present, and what are their relative abundances over different temporal periods and site conditions? To answer these questions, avian monitoring technicians must visit each site and collect detailed information on bird use and site conditions.

Drawing meaningful conclusions from this data requires a statistically robust sampling design. TNC generated sample points using a Generalized Random Tessellation Stratified (GRTS) procedure that maximally disperses points to increase the probability that sample points are statistically independent and less likely to be biased. To achieve this, ArcGIS Online provides a mapping environment that supports field monitoring teams and is accessed using the Explorer for ArcGIS mobile app. The mobile web map includes data on bid locations, sampling point locations, associated monitoring zones (monitoring zones extend in a 200-meter radius from each sampling point), and aerial imagery. Armed with iPads, field monitoring teams are able to navigate to each monitoring location using Explorer for ArcGIS, which displays street names. Teams verify program enrollment, landowner, and sampling point information, accessing it from map pop-ups. They also install monitoring stakes and conduct bird surveys and site condition and compliance monitoring at recurring intervals.

Optimizing Bird Surveys

Historically, TNC—as well as most other organizations conducting field research and monitoring—has used paper surveys to record field observations. Once staff returned from the field the data was transferred to computer spreadsheets. However, there was strong interest in having this information recorded in a digital format from the onset of monitoring so that it could be uploaded to a central data location

Four Lessons Learned from the BirdReturns Project

The BirdReturns team learned a number of lessons through implementation that will improve similar efforts in the future.

1 It is critical to gain a thorough understanding of workflows prior to implementation.

When translating paper-based workflows to (primarily) digital format workflows, ensure that the digital versions meet the practical and logistical needs of all teams. This will require a significant amount of time, collaboration, and testing.

Meeting with field staff to clarify the logical progression of data recording steps is vital. These meetings are needed to understand the full range of constraints and conditions staff deal with in the field. This preparation allowed TNC to design mobile digital forms that were intuitive and would efficiently support fieldwork, not impede it. Meeting with managers to understand team information needs and timing was also critical to success.

Thoroughly understanding the teams' requirements in terms of data collection, management, and information flow paid significant dividends in the form of mobile workflows that were robust and easy to use. They required very little alteration during the survey season, thus minimizing disruptions to workflows and inconsistencies in data records.

2 Minimize data disruptions by leveraging systems that can seamlessly synchronize data updates while users continue through their workflow.

Using ArcGIS Online in combination with the Explorer for ArcGIS app allowed office staff to edit layers and web maps based on changing conditions, while field staff could rely on having the latest web maps.

3 Minimize the learning curve where possible.

Deploying apps on iPad minis and iPhones—devices that were already familiar—allowed the team to focus on learning specific apps.

4 Structure the workflow on multiple, independent apps to provide implementation flexibility and durability.

Do this instead of being locked into a single proprietary solution that can limit the ability to adapt to changing end-user needs. Using independent apps to address different data collection and management requirements resulted in a robust suite of tools that efficiently supported the BirdReturns work. Apps were selected based on their suitability for specific tasks as well as their interoperability with other technologies being used. This solution provided the development team with the flexibility to swap apps without destabilizing the overall approach.