Preliminary Report: Iowa National Bobwhite Grassland Initiative – Focal Area Coordinated Implementation Program (CIP)

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EXECUTIVE SUMMARY

Iowa's ten-year CIP focal area project demonstrated bobwhite quail populations can be improved through implementation of quail habitat management practices at the focal area scale of 6,000 Ac. A primary goal for CIP focal areas was to create or enhance 1,500 Ac of quail habitat comprising 25% of the 6,000 Ac focal area by year 5 of the project and maintain this habitat thru year 10. The Ringgold focal area approached the 25% habitat goal (20%; 10-year mean) while the Shawtee area achieved 8% (10-year mean) quail habitat, both focal areas maintained managed habitat throughout the 10 years of the project. Fall densities on the unmanaged reference area increased at an average rate of 0.026 coveys/40 Ac/yr during the course of the study, whereas densities on the managed Ringgold and Shawtee focal areas increased at a rate of 0.067 and 0.043 coveys/40 Ac/yr, respectively. The rate of change on Ringgold was 160% and 68% higher than the reference area and Shawtee, respectively. The Ringgold rate was likely higher because more total habitat (20% vs 8%) was enhanced on Ringgold vs Shawtee. Both focal areas achieved Iowa's target goal of one covey/40 Ac early in the study and maintained this density throughout most of the study. Quail densities improved on both focal areas without predator control, supplemental feeding, or restrictions on hunter harvest. Habitat metrics provided valuable thresholds for managers to improve quail habitat.

INTRODUCTION

Iowa has been an integral participant in the development and implementation of the 25-state National Bobwhite Grassland Initiative (NBGI) plan since its inception in 2001. The overall goal of the plan is the restoration of huntable bobwhite quail populations, hereafter quail, across the species primary range. As part of the 2011 plan revision the NBGI challenged each state wildlife agency to establish at least one quail habitat management demonstration area or "focal" area as part of a Coordinated Implementation Program (**CIP**). State participation in the NBGI/CIP is voluntary. The CIP provided no manpower or funding for implementation, resources for habitat management and monitoring were wholly the responsibility of the states.

The CIP is a science-based initiative designed to demonstrate that quail populations, as well as populations of other early-successional habitat dependent species, can be recovered when the proper amount and arrangement of habitat is provided (Morgan et.al., 2016). The CIP provides a framework for large-scale quail habitat management using a tiered approach to landscape planning and action. As a strategic habitat conservation plan the CIP uses coordinated and standardized survey protocols across the 25 states to collect range-wide data on quail populations and habitat in a "plan, do, learn" adaptive management framework to improve the effectiveness of quail habitat management. The CIP has three hierarchical tiers that include focal areas (smallest), landscapes (county or larger), and regional scales (states or larger). States were given a 10-year time frame to demonstrate that habitat management on focal areas would improve quail populations. Each state was also required to establish a reference area without intensive habitat management to serve as a comparison to focal areas. To evaluate the population response to habitat work, states were required to survey population densities in fall; however, states with small populations were able to supplement counts with additional spring surveys. Spring counts also document the response of other early successional song birds to habitat improvements in states where quail densities are extremely low.

The North American Bird Conservation Initiative (**NABCI**) divides North America into 67 Bird Conservation Regions (**BCR**) that contain similar land cover. The CIP allowed states to establish focal and reference areas on public or private land. The CIP also recommended that land cover within focal and reference areas should be within 10% of the two dominant land covers within the BCR as measured by National Land Cover Data (**www.mrlc.gov**). Land cover within focal and reference areas, if possible, was to be representative of the BCR where the areas were located, so CIP habitat management results could be broadly applied across landscapes with similar land cover. The CIP did not specify a minimum size for state focal areas, only that a focal area 1) contain at least 1,500 acres of quail habitat, the theorized habitat necessary to maintain a minimum viable population, and 2) be comprised of at least 25% quail habitat to ensure connectivity among habitats within the focal area. These two requirements that a focal area be 25% habitat and contain a minimum of 1,500 acres of habitat yield a focal area size of approximately 6,000 acres (1,500Ac is 25% of 6,000Ac).

The 1,500-acre habitat minimum is a hypothesis based on the bobwhite movement study of Terhune et al. (2010) and the minimum viable bobwhite population work of Guthery et al. (2000). A minimum viable population size for a species is a function of the interacting effects of population growth (the species' reproductive potential; e.g., breeding age, fecundity) and population depressors that are natural (e.g., weather, predation, old age, disease) and man-made (e.g., harvest). A population subject to winter catastrophes (i.e., populations at northern latitudes; e.g., snow, ice, cold) and 40% harvest (maximum recommended by NBGI) would require a beginning fall population of 400 quail to be sustainable. If that population would be subject to both summer and winter catastrophes then the beginning fall population should be 800 (Guthery et al. 2000). Many states listed a fall density goal of around 3 acres per quail. Given this density and a minimum viable population of 400-800 birds, the minimum amount of habitat to support a viable population would be 1,200-2,400 acres, the CIP settled on a 1,500 Ac threshold. The 25% habitat cutoff is based on Hannon (2010), which reviewed studies on critical thresholds for habitat loss. A critical threshold occurs when populations decline more rapidly at low levels of habitat in the landscape. The authors found critical threshold values can vary by species and landscape, but many species had a minimum threshold between 20-30%, the CIP settled on 25%.

The CIP has both population and habitat goals, including 1) to achieve 50% of a state's target fall quail density in <5 years and 100% by ten years, and 2) to achieve 100% of the quail habitat target (≥1,500 acres) in <5 years and maintain that habitat until year 10. Iowa's target fall quail density was 1 covey per 40 acres in the fall or about one bird per four acres assuming a fall covey size of 10 birds. Iowa conducted both spring counts of whistling male quail and other song birds and fall quail covey counts, however this report provides a preliminary summary of only the fall covey count data over Iowa's 10-year (2013-2023) effort.

As a service to states, the NBGI provides a national database for data collection and will complete a region-wide analysis of the data to inform habitat management across the 25-state quail range. The inclusion of any given states data in the analysis will be determined according to which states provide monetary funds to the NBGI for completing the analysis. This determination is on-going and to-date does not include Iowa, although, the Iowa Department of Natural Resources (DNR) Wildlife Bureau is looking for other funding opportunities to be included in the larger analysis.

STUDY AREAS

The CIP recommended the 2 dominate landcovers within focal and reference areas be within 10% of the 2 dominate landcovers in the BCR where they were located. Iowa's focal areas were located in the Eastern Tallgrass Prairie (BCR22) where the 2 dominate land covers were cropland (53%) and grassland (25%), thus focal and reference areas preferably needed land cover composition in the range of 43-63% for crops and 15-35% for grasslands (Table 1). Iowa chose to have two CIP areas, the Ringgold focal area (6,471 Ac - 2013) in Ringgold county, which contained the Ringgold Wildlife Management Area (WMA; 2,519Ac), and the Shawtee focal area (5,813 Ac - 2014) in Fremont county, which included the Shawtee WMA (1,216Ac; Table 1; Fig 1). These areas were selected for several reasons including: Iowa DNR wildlife management unit staff were interested in implementing intensive quail habitat management, both areas historically had good quail populations, on-going counts and habitat manipulations were being conducted, and the amount of public land made reaching 1,500-acres of habitat within the 6,000 Ac focal area feasible. Both the Ringgold and Shawtee focal areas included surrounding private lands to meet the 6,000 Ac CIP threshold (Fig 1). Neither focal area completely met the CIP dominant landcover recommendations, Ringgold had less crop and more grassland than BCR22, while Shawtee had more cropland than BCR22 (Table 1). Iowa's decision to choose focal areas not matching precisely with CIP protocols was a tradeoff between participating in the CIP or not. The CIP authors favored Iowa's participation even though our focal areas did not fall completely within protocols. Land cover within Iowa's reference area met CIP guidance for the two dominant land covers for BCR22 (Table 1). The reference area (5,760 Ac - 2013) was also located in Ringgold county, north of the

Table 1. Land cover within BCR22 and Iowa focal and reference areas.

		CIP*	Study Area Landcovers		
Land cover	BCR 22	Targets	Reference	Ringgold FA	Shawtee FA
Barren/Dev	7%		3%	3%	2%
Crop	53%	43-63%	47%	17%**	72%**
Forest	14%		14%	30%	5%
Grassland	25%	15-35%	35%	47%**	21%
Water	1%		1%	1%	0%

Shaded - Two predominant land covers within BCR 22 (Eastern Tallgrass Prairie).
* CIP protocol specified the two predominant land covers within focal and reference areas should match (±10%) the two predominant land covers within the BCR.
** Land cover outside of CIP recommendation.

Ringgold focal area and was primarily private agricultural land. The reference area contained CRP lands and the Connie Huff WMA (300 Ac) managed by the Ringgold CCB, but otherwise received no active quail habitat management.

METHODS

Fall Counts/Density

This report provides a summary of methods outlined in the CIP; detailed methodology may be found in Morgan et al. (2016) or on the CIP **website**. Under the CIP design, all states collected fall covey call counts using 500-m radius point counts. Focal and reference areas were randomly assigned 8 to 10 fall points and survey points could fall on either private or public lands. Fall points and their respective buffers covered approximately 20% of the area within each study site (Figs 1&2). Spring and fall covey counts were conducted twice each year, with 1-2 weeks between counts, with data entered directly into a spatial geodatabase (Arc Collector/Field Maps). The time and distance (m) to each spring bird or fall covey was recorded. Other priority early successional birds monitored in the spring in addition to male quail were bobolink, eastern meadowlark, field sparrow, grasshopper sparrow, and ring-necked pheasant. Fall covey counts began 50 minutes prior to sunrise until sunrise and only the location of first detection of each covey was recorded.

Figure 2. Example survey point where an observer counted birds and the habitat patches in a 250m radius around the point were estimated.

Fall covey counts are reported as the arithmetic mean of repeated counts by point and year. Additionally, fall quail density estimates were derived from fall covey count data, using data from all states (n=24), with models in package Distance in program R version 4.3. To produce density estimates, a detection function was first fit using fall covey count data from each year with a uniform key, cosine adjustment, and 5% truncation distance, with states set as "study areas", each Focal/Reference area set as the "region" within each study area, and each sampling point defined as the "sample label". Effort was defined using the number of distinct dates (repeated counts) for submitted data at each sample label within a given year. A conversion factor was defined to convert units from meters to acres. Coveys were not flushed in the fall, so a bird per acre density estimate is not possible. Fall densities are reported as coveys per 40 acres. CIP fall density estimates were compared between focal and reference areas using general linear models ($P \leq 0.05$) within SAS. This overall comparison of fall CIP densities between focal and reference areas, are the only results that NBGI has provided Iowa as far as analysis (Table 2).

Because of the difference in landcover between focal and reference areas (Table 1) an additional analysis was conducted comparing points within each focal area that received habitat management (managed) with those that did not (unmanaged). Unmanaged points within the focal areas were primarily points located on private land, three on Ringgold (points 4, 21, 23) and two on Shawtee (points 3606, 3607), and received little or no active habitat management for quail (Table 2, Fig 1). Unmanaged points had surrounding landcover similar to managed points on each focal area, and provide an additional area specific comparison of habitat management over the CIP focal vs refence area comparison. This assumes the bird densities on unmanaged points were not supported by those on managed points on Ringgold or Shawtee. Fall density estimates for managed and unmanaged points were calculated using the same R package and general linear models within SAS, but only include Iowa data. The SAS least squared means procedure was used to detect differences between main effects of area (Ringgold/Shawtee) and management (managed/unmanaged) and any interaction.

Habitat Monitoring at Points

Habitat monitoring on focal areas and reference areas served several purposes: 1) to assess annual habitat management progress; 2) to determine if 5 and 10-year habitat goals were achieved; 3) to compare habitat change in focal and reference areas with quail population change; and 4) to compare land cover change in focal and reference areas with quail density change. Habitat monitoring focused on evaluating the structural characteristics of land cover (e.g., proportion of bare ground, proportion of shrub cover) rather than type of land cover (e.g., forest, row crop, CRP) or land use (e.g., corn production, grazing). Habitat patches were surveyed during late summer in project years 1, 5, and 10. Survey plots consisted of a 250 m radius (48 acres) around each fall point location in which cover types were visually assessed by an observer on-foot and digitized by cover patch using Arc Collector/Field Maps (Fig 2). If the 250 m plot

extended beyond the focal area boundary, habitat was visually estimated from the road but patches were not walked due to the lack of permission. A patch was defined as any relatively homogenous contiguous cover type with an area greater than 900 m^2 (~ quarter of an acre) that varied significantly from adjoining patches (e.g., 1-year burned/disked verses 2-year burned/disked native grass field; see Morgan et al. 2016 for greater details). To summarize habitat around each survey point, the arithmetic mean for each metric was estimated for all habitat patches delineated within survey buffers. Habitat was classified at 3 levels:

1. Canopy ≥12 ft in height (including, percent of canopy >12 ft in height, percent of canopy in deciduous cover, and percent of canopy in coniferous cover)
2. Understory <12 ft in height (including, percent shrub cover and percent of that the shrub cover with a high stem density near the ground)
3. Ground level (including, percent cover in developed land/non-habitat, percent grass cover, percent forb cover, percent of the forb cover that can act as protective cover, number of forb species, percent bare ground, and whether herbaceous vegetation height was > 8 inches for ≥ 50% of the year).

Focal Area Habitat Management Practices

In addition to detailed habitat measurements around survey points, habitat management practices designed to benefit bobwhite, were tracked and digitized annually on each focal area. The CIP defined a quail management practice as an activity that a state fish and wildlife agency would be willing to pay a landowner to implement for the benefit of quail (Table 4). Habitat management activities were conducted primarily by Iowa DNR management and private lands staff. Private landowners within each focal area were contacted and provided information on the project and quail habitat management practices, however virtually all habitat management practices described in Table 4 were conducted on the public land (WMA) within each focal area.

RESULTS

Fall Counts/Density

Habitat management and fall counts on Ringgold were initiated in 2009, 4 years prior to CIP monitoring. These pre-CIP fall covey counts on Ringgold, by DNR staff, followed similar protocols to CIP, except counts were not repeated. However, these data provide a valuable trend related to habitat management efforts pre-CIP. Figure 3, shows the estimated fall covey density on Ringgold prior to CIP implementation in 2013 (light green portion of line). Estimated fall density on Ringgold increased from 0.18 coveys per 40 acres in 2009 to a high of 2.5 coveys per 40 acres in 2018 (1000%+ increase).

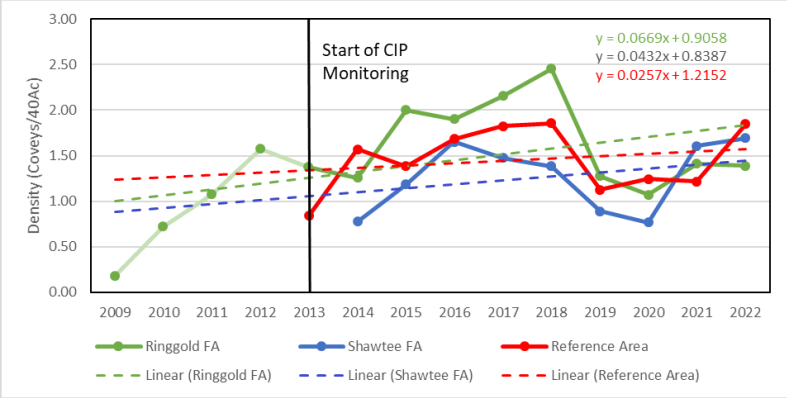

Figure 3. Rate of change in NBGI fall covey density estimates on Iowa sites, 2013-22. *Ringgold pre-CIP covey densities estimated from relationship of fall CIP density to raw fall covey counts*.

Overall fall density estimates for the 10 years of CIP surveys (2013-22) averaged 1.5 (95% confidence limit [CL] 1.0–2.2) coveys/40Ac on the reference area, 1.6 [95% CL 1.1–2.5) coveys/40Ac on the Ringgold focal area, and 1.3 [95% CL 0.7–2.4) coveys/40Ac on the Shawtee focal area (Table 2). Fall densities did not differ (P= 0.17) between the focal areas and the reference area. All 3 areas showed a general increasing trend in density from 2013-18, a decline in 2018, and a rebound through 2022 (Fig 3). The decline in 2018 was due to a severe winter in 2018-19. The plot of densities over the course of the study (Fig 3) showed the rate of change on both focal areas was greater than the reference area, but the difference in slopes was not significant (P = 0.379).

The comparison of managed to unmanaged points on the combined focal areas showed fall densities on managed points were twice as high (1.6 coveys/40Ac vs 0.8 coveys/40Ac (P = 0.004)) as unmanaged points (Table 3). Mean fall densities were higher (P = 0.024) on the Ringgold compared to Shawtee on both managed and unmanaged points. The interaction of area by management type (managed/unmanaged) was not signficant (P = 0.42), indicating managed points had higher fall densities than unmanaged points on both focal areas (Table 3).

Table 2. Mean fall count, CIP density estimate, and structural composition of patches within 250m of fall points in each focal area and the reference area and focal areas combined, habitat surveyed in years 1, 5, and 10 of the project, 2013-22.

				Habitat Metrics[3]									
Area	Point	Uncorrected[1] Fall Covey Count	CIP Fall[2] Density (Coveys/40Ac)	Number Patches	Number Crop Patches	Crop Acres	% Canopy >12ft	%Shrubs	%Grass	%Forbs	Number Forbs	%Bare	Herb > 8" for 50% Yr
Ringgold FA	1	4.1		23.0	2.7	4.8	12.4	12.5	50.2	43.1	9.6	23.7	95%
	4*	2.6		12.7	1.3	4.1	3.5	8.7	71.8	26.3	5.7	11.1	65%
	7	4.9		26.3	2.0	4.4	5.9	9.2	45.5	54.5	7.7	13.2	97%
	10	4.0		35.3	2.0	1.5	7.1	22.5	46.4	41.9	11.4	29.9	97%
	13	3.8		29.7	1.7	1.6	5.6	6.0	53.2	48.3	11.1	22.7	95%
	18	3.6		17.3	1.7	2.6	12.6	10.7	69.1	42.2	7.7	11.7	72%
	21*	2.9		18.3	1.0	1.8	19.4	20.5	39.5	48.9	9.9	13.7	98%
	23*	2.1		12.7	0.0	0.0	17.1	8.8	46.2	43.3	7.7	12.1	89%
	Mean	3.5	1.6	21.9	1.5	2.6	10.5	12.4	52.7	43.5	8.9	17.3	89%
Shawtee FA	3601	2.3		15.3	4.0	2.1	13.4	15.7	48.6	58.9	7.2	55.6	97%
	3602	4.1		22.0	6.3	1.7	5.7	8.4	69.7	36.6	5.0	33.2	95%
	3603	3.9		19.0	4.7	4.2	7.2	4.4	74.1	32.4	5.5	32.5	95%
	3606*	0.8		12.7	5.3	5.2	12.7	5.3	74.9	21.6	2.9	26.4	82%
	3607*	0.6		13.3	7.0	5.9	0.0	0.4	91.3	16.9	1.9	12.2	84%
	3608	3.3		17.7	5.0	3.0	11.1	7.3	70.8	33.7	4.3	32.7	84%
	3609	2.4		16.7	2.7	9.3	1.0	4.4	81.7	32.2	5.1	16.0	88%
	3611	3.9		22.3	8.0	3.4	9.8	7.8	76.3	33.3	3.5	25.7	95%
	Mean	2.7	1.3	17.4	5.4	4.4	7.6	6.7	73.4	33.2	4.4	29.3	90%
Reference	102	3.2		8.7	3.3	4.5	7.8	4.1	74.7	26.9	3.7	16.8	94%
	103	2.6		9.7	0.0	0.0	8.0	6.8	69.1	33.3	6.7	10.2	55%
	105	2.6		7.3	2.7	6.5	0.0	1.7	85.1	26.4	3.3	13.9	50%
	117	3.1		5.0	1.0	4.9	20.0	20.7	57.0	41.3	4.5	23.3	75%
	124	3.5		4.7	1.0	21.5	11.9	3.6	86.3	9.3	2.9	8.9	64%
	130	3.3		9.3	3.7	8.6	6.9	6.1	50.3	53.9	4.4	10.6	47%
	133	4.0		8.7	4.0	8.8	19.5	6.6	69.6	34.2	5.6	5.8	100%
	134	2.8		6.7	2.0	18.4	26.5	25.4	34.7	46.4	6.7	20.8	86%
	Mean	3.2	1.5	7.5	2.2	9.2	12.6	9.4	65.8	34.0	4.7	13.8	71%
Focal Combined		3.1	1.5	19.6	3.5	3.5	9.0	9.5	63.1	38.4	6.6	23.3	89%
Reference		3.2	1.5	7.5	2.2	9.2	12.6	9.4	65.8	34.0	4.7	13.8	71%

* Unmanaged points - points that were mostly private unmanaged land and/or received little DNR habitat management for bobwhite.

1 Uncorrected fall covey count is the 10-year average of all counts for each point.

2 CIP density estimates use data from a global model of all 25 participating states to derive estimates.

3 Habitat metrics are the average value of all non developed patches surrounding the point across survey years 1, 5, and 10 (e.g., the 23 patches in point 1 had a mean of 12.5 % shrubs). Canopy, shrub, and understory estimates included cropland acres as well as grassy and woody patches in calculations.

Habitat Metrics - Focal Areas verses Reference Area

Table 2 shows the mean habitat metrics of patches associated with each point by area. Ringgold had a patchier landscape, with an average of 24 patches around survey points compared to 18 patches at Shawtee. Ringgold had fewer crop patches, more shrub and tall tree patches, and an understory with less grass, more percent forbs, greater forb numbers, and less bare ground on average than Shawtee. Combined the focal areas had greater patch diversity (19.6

Table 3. Mean fall counts, fall density, and structural composition of patches within 250m of managed and unmanaged points by focal area and combined, habitat surveyed in years 1, 5, and 10 of the project, 2013-22.

			Habitat Metrics									
Area	Uncorrected Fall Covey Count	IA Fall Density^ (Coveys/40Ac)	Number Patches	Number Crop Patches	Crop Acres	% Canopy >12ft	%Shrubs	%Grass	%Forbs	Number Forbs	%Bare	Herb > 8" for 50% Yr
Ringgold FA												
Managed Points	4.1	1.9	26.3	2.0	3.0	8.7	12.2	52.9	46.0	9.5	20.2	91%
Unmanaged Points	2.5	1.1	14.6	0.8	2.0	13.3	12.7	52.5	39.5	7.8	12.3	84%
% Difference		73%	81%	161%	53%	-35%	-4%	1%	17%	22%	65%	9%
Shawtee FA												
Managed Points	3.3	1.5	18.8	5.1	4.0	8.0	8.0	70.2	37.8	5.1	32.6	92%
Unmanaged Points	0.7	0.4	13.0	6.2	5.6	6.4	2.8	83.1	19.3	2.4	19.3	83%
% Difference		275%	45%	-17%	-29%	26%	184%	-16%	96%	111%	69%	11%
Combined FA's												
Focal Managed Points	3.7	1.6	22.2	3.7	3.5	8.4	9.9	62.3	41.5	7.1	27.0	92%
Focal Unmanaged Points	1.8	0.8	13.9	2.9	3.4	10.6	8.7	64.7	31.4	5.6	15.1	84%
% Difference		100%	60%	26%	3%	-21%	13%	-4%	32%	26%	79%	10%

^ IA density estimates comparing managed and unmanaged points derived using only IA data.

Shaded values show habitat metrics with the largest difference between managed and unmanaged points by focal area and areas combined.

and 7.5 patches, respectively), fewer row crop acres, greater forb numbers in the understory, and more bare ground in the understory compared to reference area (Table 2).

Habitat Metrics - Managed verses Unmanaged Points on Focal Areas

Analysis comparing managed to unmanaged points (Table 3) showed Ringgold's managed points had more and larger crop patches, fewer tall trees, and more bare ground on average than unmanaged points. On Shawtee managed points had more patches, containing more shrub cover, more percent forbs, greater forb numbers, and more percent bare ground on average than unmanaged points. Combined managed points within focal areas had more habitat patches (60%), with greater percent forbs (32%) and more percent bare ground (79%) in the understory on average within patches than unmanaged points (Table 3).

Focal Area Habitat Management

The Ringgold WMA within the Ringgold focal area was 2,519 Ac; thus, the CIP goal of 1,500Ac of quail habitat could be achieved strictly on the WMA if approximately 60% of the WMA were in managed quail habitat. Ringgold unit staff reached the 1,500-habitat goal in 2016, 2018, 2021, and 2022, and thus, also achieved the 25% overall habitat in the 6,000 Ac focal area during these years (Table 4). The Shawtee WMA was only 1,219 acres so even with 100% of the WMA managed as quail habitat it could not meet the 1,500Ac threshold specified in the CIP, without surrounding private landowners implementing quail habitat management. Managed quail habitat on the Ringgold and Shawtee focal areas across the 10-year study averaged 1,268 Ac/yr (20% of the focal area) and 459 Ac/yr (8% of the focal area), respectively. No private landowners within the focal areas did any management for quail. The only habitat management that occurred on private lands was the required mid-contract management on the few CRP contracts within focal areas and this management was not done specifically for quail.

Table 4. Habitat management activities (acres) conducted on each focal area from 2009-15. Percentages show the proportion of the WMA/focal areas receiving habitat management for quail.

	Ringgold FA															Shawtee FA								
Management Activity	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Mean[1]	2015	2016	2017	2018	2019	2020	2021	2022	Mean
Brush Management – Chemical																	1		3					2
Brush Management – Mechanical																			2	58				30
Disking – Whole Field		33	46	32	33	50	58	51	68	65	55	35	38	55	51									
Edge Feathering									7		24	16	52	56	31	13	10	2	7	3				7
Establishing Herbaceous Cover					38	13	109	64	16				22	2	38	77	48	54	16	17		48	32	42
Establishing Shrubs			2	2	2	2				4					3									
Fallowing/Idling								11	24	32	43	33	38	26	30	104	118	86	32	138	152	171	153	119
Fire – Dormant Season		92	34		250		27	136	32						111									
Fire – Growing Season	846	161	402	673	131	379	392	624	400	764	620	244	990	836	538	79	197	114	149	383	329	293	239	223
Food Plots					61	60	59	55	60	67	36	48	69	52	57	36	42	34	33	45	43	33	35	38
Forest Management – Clear Cut (> 5 acres)		120			16		21	13		4					13							72		72
Forest Management – Thinning						13	32	7							17									
Grazing – Rotational					452	452	452	452	452	452	381	381	381	381	424									
Haying – Deferred								25	10	10	10	10	5	5	11	5		28	5					13
Herbaceous Chemical Control – Broadcast Spraying		57	36	19	12	160	84	63	37	125	70	63	45	68	73	34				37				35
Herbaceous Chemical Control – Spot Treatment																15	15	15	23					17
Total Managed Acres on WMA	846	465	519	725	994	1,129	1,234	1,500	1,107	1,522	1,240	830	1,641	1,481	1,268	362	431	332	270	680	524	617	459	459
Proportion of WMA*	34%	18%	21%	29%	39%	45%	49%	60%	44%	60%	49%	33%	65%	59%	50%	30%	35%	27%	22%	56%	43%	51%	38%	38%
Proportion of Focal Area*	13%	7%	8%	11%	15%	17%	19%	23%	17%	24%	19%	13%	25%	23%	20%	6%	7%	6%	5%	12%	9%	11%	8%	8%

1 Means only include data from years of CIP monitoring 2013-22.

* For proportions the Ringgold WMA and focal area were 2,519 Ac and 6,471 Ac, and Shawtee WMA and focal area were 1,216 Ac and 5,813 Ac, respectively.

DISCUSSION

The overall goal of the CIP was to demonstrate, across the entire continental quail range in the United States, quail populations could be increased with focused habitat management (Morgan et.al. 2016). Since no states had pre-existing data following standardized protocols, the CIP established a study design comprising focal and reference areas to evaluate quail responses to habitat management. States were encouraged, but not required to select landscapes with similar habitat, and assume similar quail populations in year 1 and measure population changes in response to habitat management over a 10-year period. Two focal areas were selected in Iowa with abundant public land to achieve the CIP goal of 25% managed habitat within the 10-year study period. However, by choosing Ringgold and Shawtee as our focal areas, neither had landcover similar to the reference area or each other (Tables 1 & 2) thus making it unlikely quail populations were similar in the first year of the project. In Iowa, the lack of similar initial landcover and likely quail densities makes a direct comparison between focal and reference areas problematic.

Fall Counts/Density

By study site the estimated fall covey density across all 10 years averaged 1.6, 1.3, and 1.5 coveys/40 Ac on the Ringgold, Shawtee, and reference area, respectively (Table 2). Each focal area averaged greater than 1 covey/40 Ac; the density goal set for Iowa focal areas at the beginning of the project. In a 1931 game survey of Iowa, Leopold (1933) indicated in southern Iowa 1 covey/20-60 Ac was common at most farms reporting good quail habitat. Both focal acres maintained 1 covey/40 Ac or better across most of the study period, and were thus on par with historical densities in good habitat. Ringgold achieved a fall density of approximately 2 coveys/40 Ac for 4 consecutive years (Fig 3). Shawtee maintained fall covey densities over 1 covey/40 Ac for every year except the first year of study and the 2 years following the severe winter of 2018, when densities fell to first year levels (Fig 3).

The reference area also maintained greater than 1 covey/40 Ac across 9 of the 10 years, suggesting habitat management on the focal areas had little impact on quail populations. However, the differences in primary landcover complicate a direct comparison between the focal and the reference sites in 2 potential ways: 1) landcover and thus bird numbers, were likely not similar at the start of the study and 2) landcover on private land within the focal areas was different than that on public land. Related to first issue, if quail densities were not similar at the start of the project then the comparison of reference area densities to focal area densities could be misleading. On Ringgold, pre-CIP (2009-2012) density estimates (Fig 3) suggests initial quail populations were much lower than the reference area. The Ringgold focal area had much more timber on it than the reference area. The Shawtee focal area was much more intensively row cropped than the reference area. Landscapes dominated by timber or row crops support lower quail densities than landscapes with greater landcover diversity (Rosene 1969, Stoddard 1931, Woolf et.al 2002). Related to the second issue, the CIP design implicitly assumed habitat management would occur randomly throughout the focal area, but on Iowa focal areas habitat management occurred almost exclusively on public lands with virtually none on private lands. Because survey points were randomly placed, several survey points in both focal areas fell entirely or partly on private land and had little or no habitat management over the 10 years of the study. Both of these factors likely contributed to the lack of statistical difference in the averaged 10-year quail density estimates between the focal and reference areas (Table 2).

If the reference area was considered the baseline and representative of quail populations and habitat within BCR22 in southern Iowa, then quail populations generally increased across the 10 years of the study (Fig 3). Southwest region Iowa August roadside count data also show an upward trend in quail numbers from 2013-22, similar to reference area density trends. Comparing the annual rate of change in fall densities on the focal areas (Ringgold 0.067 coveys/40 Ac/yr and Shawtee 0.043) showed both increased at a greater rate than on the reference area (0.026; Fig 3). While these slopes were not significantly different, densities on both focal areas increased at a faster rate than the reference area, suggesting habitat management did increase focal quail densities over the reference area baseline. Likewise, managed points (1.6 coveys/40 Ac) produced much greater fall densities than unmanaged points (0.8 coveys/40 Ac) on both focal areas (Table 3).

Habitat Metrics

Direct comparison of habitat metrics between focal and reference area survey points showed the focal areas generally had a more diverse landscape with a greater number of smaller patches, more bare ground, more diversity of forbs in the understory, and less cropland in smaller patches than the reference area (Table 2). Landscapes with a diversity of cover types in small patches, with abundant bare ground and more forbs have been shown to be favorable to quail populations (Guthery 1997, Rosene 1969, Stoddard 1931).

Habitat metrics between managed and unmanaged points revealed that cover type diversity (number of patches), proportion of forbs in the understory, and proportion of bare ground in the understory of patches were important predictors of quail density across both focal areas. Within focal areas, landscape attributes did influence values of certain cover types. On Ringgold where the landscape had less row crops and more tall canopy trees, the higher quail densities on managed points had more row crop patches and less canopy vegetation >12ft in height. The proportion of shrubs and forbs on Ringgold did not appear limiting in this landscape as both managed and unmanaged points had similar proportions. Proportion of bare ground in the understory was predictive of higher densities at Ringgold. At Shawtee, where the landscape had fewer but larger patches of row crops, fewer shrubs, and less understory forb diversity, managed points had more patch diversity, more shrub component, and greater forb diversity than unmanaged

points, suggesting these were the limiting factors in this row crop intensive landscape. Similar to Ringgold the proportion of bare ground in the understory was an important predictor of quail density on Shawtee. These differences between the focal areas suggest that habitat management activities to improve quail densities can vary based on the structure of patches comprising the local landscape.

Focal Area Habitat Management

The Ringgold focal area was able to achieve the 1,500 Ac habitat goal and the 25% habitat connectivity threshold by year 4 of CIP monitoring and essentially maintained it thru the end of monitoring in 2022 (Table 4). Shawtee focal area achieved a peak of 12% quail habitat in year 5, only half of the CIP recommended habitat (25%), and averaged about 10% quail habitat during the last 4 years of the project (Table 4). The Shawtee focal area was dependent upon private landowners to achieve the CIP acreage goal and there was little interest from adjoining landowners to create quail habitat. The lower rate of annual increase (Fig 3) on Shawtee is likely related to lower proportion of quail habitat in the overall focal area (8%) compared to Ringgold (20%). However, both focal areas showed response by quail even though habitat on Shawtee did not meet theoretical goals. The annual rate of increase in the reference area was somewhat surprising but southern Iowa generally experienced very favorable weather (especially winter weather) for quail from 2013-23. The accumulated winter weather severity index (Boustead et al. 2015) in Clarinda, Iowa indicated that only 3 winters (2013, 2018, and 2020) were above average severity during this study, with the period from 2014-18 all below average (MRCC 2024). For the reference area to have a mean density of 1.5 coveys/40 Ac over the course of the study suggests the general composition, configuration, and interspersion of habitat types in BCR22 is amenable to quail persistence assuming habitat composition and configuration in the reference area is representative of the entire BCR22 region in southern Iowa. This is a good omen for bobwhite quail across southern Iowa as long as land use remains similar to what was measured in the reference area between 2013-22.

MANAGEMENT IMPLICATIONS

The general consensus of quail managers within the national quail plan is that 1 covey/40 Ac in the fall provides reasonable quail hunting densities. The CIP measured habitat around survey points at approximately this scale (Fig 2 - 250m radius equates to 48 Ac). Data from this study supports that quail utilize a mosaic of cover types at local scales (Table 3). These results suggest that natural resource managers should develop habitat with a diversity of cover type patches (20-25 patches per 48 Ac) with an average size of 2-2.5 Ac per patch. Where socially or economically feasible, row crop patches should be smaller and interspersed with grass, forb, and shrubby patches to create a mosaic landscape. Although shrub cover did not appear limiting on Ringgold, it was on Shawtee, shrub cover is critical for providing protective cover for quail and managers should maintain dispersed shrub cover on the landscape consisting of 8-12% shrub cover (<12 ft in height). Additionally, grass patches should be managed for a minimum 40% forb cover and >30% bare ground, as these characteristics tended to support the highest quail densities in this study. Lastly, forest cover (>12 ft canopy height) should be limited to no more than 9% of a typical patch actively managed for quail habitat. Our results show the patch types land managers need to prioritize for can vary based upon the local landscape (e.g., small crop fields benefited densities on Ringgold whereas shrubby cover and forb percentages appeared adequate, while on Shawtee additional shrubs and forbs benefitted densities).

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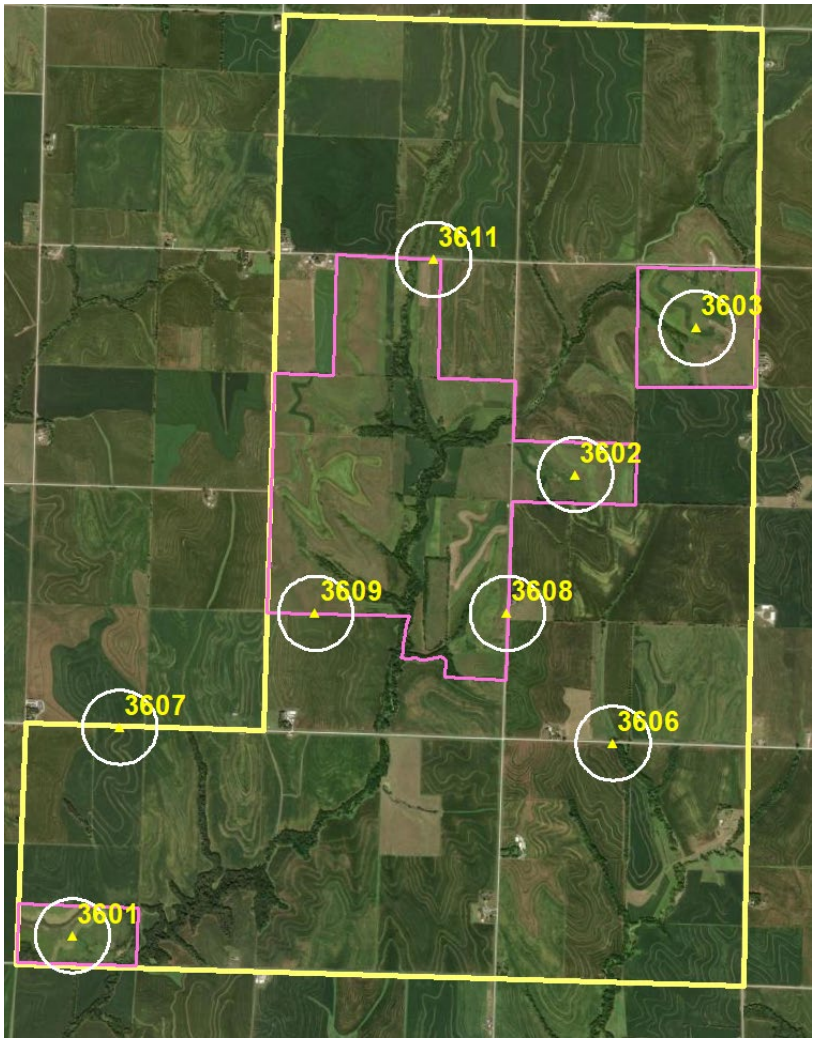
Figure 1. Location of fall survey points and 250m habitat survey buffers on Iowa focal and reference areas (A-Shawtee focal area – 5,813 Ac, B-Ringgold focal area – 6,471 Ac, and C-Reference Area – 5,710 Ac). Yellow outline denotes the area boundaries, pink outline denotes public land boundaries.



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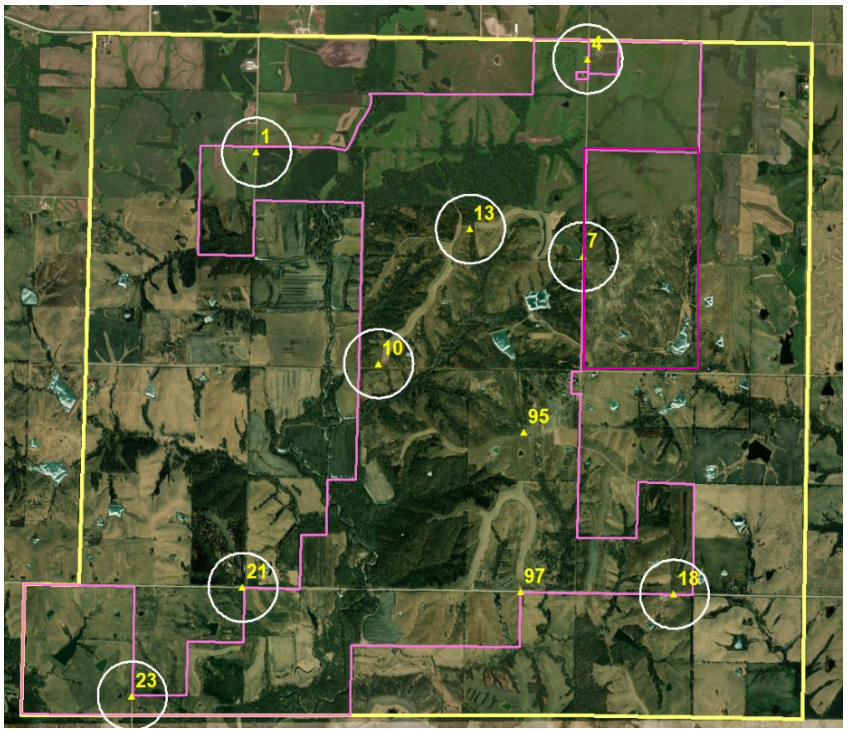

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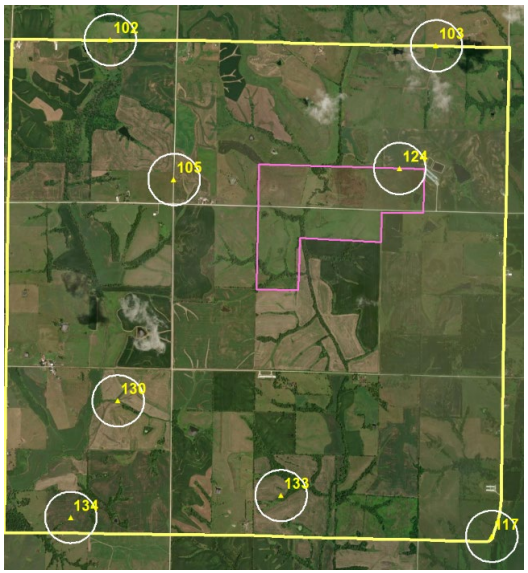

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