



Biosecurity
COMMONS

Surveillance Design – Quick Start Guide



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Surveillance Design

Pre-border measures and border control protocols constitute critical components in mitigating biosecurity risks, although complete threat elimination remains unattainable. In regions potentially exposed to biological threats, regulatory authorities implement comprehensive surveillance systems as their primary risk management framework. These systems are designed to facilitate early detection protocols, enabling authorities to identify and respond to potential outbreaks before they escalate to levels that could precipitate significant economic disruption, social instability, or environmental degradation.

Surveillance systems also serve a crucial verification function, establishing and maintaining documentation of disease-free status within specified regions. This verification mechanism is instrumental in both preserving existing trade relationships and facilitating the restoration of market access following biosecurity incidents. Furthermore, these systems generate critical data regarding ground-level response operations, including the delineation of outbreak, progression monitoring, and quantitative assessment of eradication initiatives.

Regardless of the objective, a fundamental challenge faced by surveillance practitioners is determining where to prioritise surveillance, and how much to allocate.

Biosecurity Commons provides a comprehensive Surveillance Design workflow that enables users to optimize their surveillance resource allocation through sophisticated analytical tools. This system can leverage geographic mapping capabilities, location-specific probability assessments, and actual occurrence data, while incorporating surveillance effectiveness metrics and operational constraints, including budgetary limitations and required detection confidence levels.

The workflow allows users to optimize surveillance allocation using different objectives including:

- **Minimising total costs**, that is surveillance resource costs plus likely incursion management costs (estimated with and without detection)
- **Maximising a total saving** (or monetary benefit minus surveillance costs)
- **Maximising a total non-monetary benefit measure** (e.g. species richness)
- **Maximising the number of detections** (equivalent to uniform benefit)
- **Maximising overall detection confidence or sensitivity**, that is the probability of detection if the invasive species is present

The workflow can also be utilised to determine the sensitivity of existing surveillance allocations, which may vary temporally. The existing system-wide sensitivities may then be utilised for area freedom analysis via the Proof of Freedom workflow.

For more details about the Surveillance Design please see the [Surveillance Design workflow](#) overview support article.

Linkages to other workflows

Outputs from other Biosecurity Commons workflows may be used as inputs in **Surveillance Design** workflows, for example:

- **Risk Mapping** workflows provide outputs for spatial distributions of threat suitability, arrival and establishment likelihood, which may be utilised as occurrence likelihood inputs for **Surveillance Design** workflows.
- **Population Spread Modelling** workflows provide outputs for simulated mean spatial occupancy and population abundance at collated simulation time steps, which may be utilised as occurrence likelihood inputs for **Surveillance Design** workflows.
- **Impact Analysis** workflows provide outputs for spatial distributions of the costs or non-monetary impacts of invasive species incursions, which may be utilised as saving or benefit inputs for **Surveillance Design** workflows.

Outputs of **Surveillance Design** workflows can be used directly as inputs in other workflows, for example:

- **Surveillance Design** workflows provide outputs for spatial distributions of sensitivity (detection probabilities), which may be utilised as simulated detection management action inputs for **Population Spread Modelling** workflows.
- **Surveillance Design** workflows provide outputs of system-wide surveillance sensitivities (detection probabilities) based on different optimisation strategies or existing surveillance designs, which may be utilised as sensitivity (detection probability) inputs for **Proof of Freedom** workflows to determine confidence or probabilities of absence (given no detections).
- **Surveillance Design** and **Population Spread Modelling** workflows can thus be utilised iteratively as inputs and outputs for one another to refine an effective allocation of surveillance resources.

Creating a Surveillance Design

Step 1. Create a new project

Select the Surveillance Design workflow and then select “Create a new Project”.

The screenshot shows the Biosecurity Commons interface for creating a new project. The top navigation bar includes 'Workspace', 'Datasets', and 'Workflows'. The 'Workflows' section is active, showing 'All projects' and 'Surveillance Design'. Below this, there are options to '+ Create a new Project', 'My Projects', and 'Shared With Me'. The main form is titled 'Workflow Template (required)' and lists several templates: 'Surveillance Design (empty project)', 'Orange Hawkweed, Falls Creek' (with fields for species-name: Orange Hawkweed and species-type: weed), 'Surveillance Design - Testing (empty project)', 'Animal disease sampling design' (with a demo tag), and 'Medfly 5000 traps' (with fields for species-name: Ceratitis capitata and species-type: pest). To the right, a form titled 'Fill in the following information to create a new Project for this workflow.' contains fields for 'Project Title (required)' (filled with 'Surveillance Design'), 'Description' (filled with 'Surveillance Design'), 'Species name' (Invasive species (or genus) name), and 'Species type' (Type of invasive species). A green '+ Create a new Project' button is at the bottom right.

When creating a new surveillance design project, users have the option to select an empty template, initially titled “Surveillance Design”, which can be renamed appropriately, or one of a range of prepopulated templates that have been constructed as examples of the workflow or based on previous case studies (e.g. “Orange Hawkweed, Falls Creek”).

The empty template is ideal for those wishing to create a brand-new surveillance design as it contains:

- The basic structure of the Surveillance Design workflow

- No preloaded datasets (except for the default region, albeit this can be easily changed)

By contrast, example templates provide users with the opportunity to see a completed demonstration of how surveillance designs can be produced, or if based on a real-world case study, how others have attempted to create a model.

Select a template and then give your project an appropriate title. Users can optionally provide additional descriptive details under the “Description”, “Species name” and “Species type” fields. These metadata are presently unused but will provide future flexibility in filtering and summarising projects.

Once details have been provided, click the green “Create a new Project” button in the bottom right-hand corner to continue.

When you start a Surveillance Design workflow from an empty template you will be presented with the core elements of the Surveillance Design workflow on the left side of the screen – “Surveillance”, “Design Method” and “Surveillance Design”. Orange exclamation points indicate steps that require attention and, as you progress through the project, these change to green ticks when complete.

Step 2. Specify the surveillance

Select appropriate details of the context of your surveillance, including:

- **Surveillance type:** The type of surveillance utilized in the design (e.g. surveys, traps, samples)
- **Surveillance quantity unit:** The unit to express quantities of surveillance (e.g. units, hours, traps, samples)

The screenshot displays the 'SURVEILLANCE DESIGN' interface. On the left, a sidebar shows a navigation menu with 'Surveillance' selected, 'Design Method', and 'Surveillance Design', each with an orange exclamation point icon. Below the menu is a 'My Exported Results' section. The main content area is titled 'Surveillance' and contains two configuration fields: 'Surveillance type *' with a dropdown menu set to 'survey', and 'Surveillance quantity unit *' with a dropdown menu set to 'hours'. Both fields have descriptive text below them. At the bottom of the main area are 'Save' and 'Reset' buttons. A red 'Feedback' button is visible on the right edge of the interface.

“Save” your selections when finished.

Step 3. Specify the design method

Select your surveillance design method. Currently the following methods are available:

- **Discrete Sampling:** For the effective allocation of discrete sampling across spatial locations or other aspatial divisions (e.g. categories, species)
- **Continuous Surveillance:** For the effective allocation of continuous surveillance resources across spatial locations or other aspatial divisions (e.g. categories, species)

The screenshot displays the 'SURVEILLANCE DESIGN' interface. On the left, a sidebar menu includes 'Surveillance Design' (with a 'Manage' button), 'Surveillance', 'Design Method' (selected), 'Discrete Sampling', 'Environment', 'Parameters', 'Allocation', 'Surveillance Design', and 'My Exported Results'. The main content area is titled 'Design Method' and contains a dropdown menu currently set to 'Discrete Sampling'. Below the dropdown, a text box explains that discrete sampling is used for allocating resources across spatial locations and calculating detection probabilities using Lagrange-based methods. The interface also shows 'Input Parameters', 'Information', and '[debug]' options.

Other surveillance design methods are anticipated in future versions of the Biosecurity Commons platform.

Depending on the method the user selects, different options will become available within the method sections:

- Environment – defines the location or division partitions for the design and the occurrence probability at each partition
- Parameters – defines parameters specific to the surveillance method, such as the parameters associated with calculating the sensitivity (detection probability) for given allocations of discrete samples or continuous surveillance resources
- Allocation – defines how effective surveillance resources are allocated, via optimisation approaches given chosen objectives (e.g. minimum total cost), constraints (e.g. total budget), and other optional parameters (e.g. fixed costs). Alternatively, existing resource allocations may be analysed (i.e. sensitivities calculated)

The “Environment” and “Allocation” sections are generally common to the surveillance methods.

Step 4. Specify the environment

Select the “Environment” section under the chosen surveillance method to define how the surveillance resources will be partitioned across spatial locations or other aspatial divisions, such as categories, species, or resource types. Users then specify:

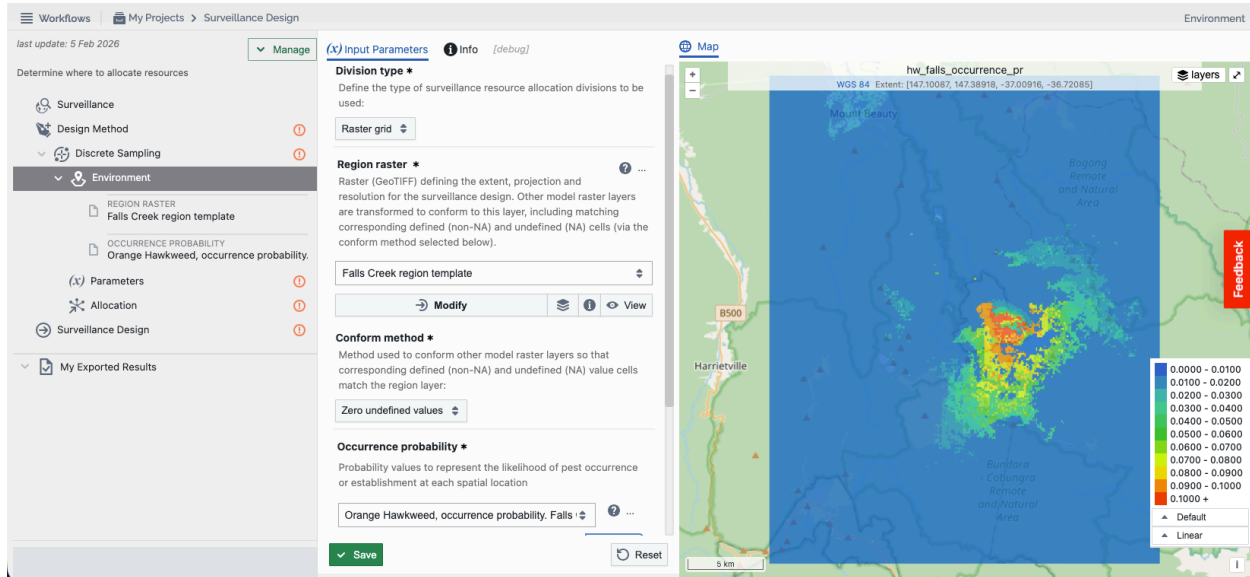
- **Division type** (*Required*): Defines the type of surveillance resource allocation divisions to be used via selection:
 - Raster grid – surveillance resources allocated across raster grid cells (GeoTIFF)
 - Spatial locations – surveillance resources allocated across spatial locations defined via longitude and latitude coordinates (CSV)
 - Other divisions – surveillance resources allocated across other aspatial divisions, such as categories, species, or resource types (CSV)

Subsequent parameters across the workflow are configured differently dependent on the division type selected (raster grid, spatial locations, or other divisions). Next, users specify either:

1. Raster grid division type

- **Region raster** (*Required*): Raster grid (GeoTIFF) defining the extent, projection and resolution for the surveillance design
- **Conform method** (*Required*): Method used to conform other model raster layers so that corresponding defined (non-NA) and undefined (NA) value cells match the region layer, select either:
 - Zero undefined values - any cells with undefined (NA) values that do not correspond to undefined (NA) values in the region layer will be set to zero. This default method is useful when available model layers differ in their spatial distribution of defined (non-NA) and undefined (NA) value cells.
 - Nearest defined values - Any cells with undefined (NA) values that do not correspond to undefined (NA) values in the region layer will be set to the (mean) value of the nearest cell(s) with defined values. This method is useful for correcting mismatching borders or coastlines, especially those with differing resolutions.
- **Occurrence probability** (*Required*): Probability values to represent the likelihood of invasive species occurrence at each region spatial location (as raster GeoTIFF). Also:
 - Specify via the “Relative probability” checkbox whether these probabilities are actual probabilities (unchecked) or relative weights (checked). Note

that actual probabilities are required for cost-based or system-wide sensitivity-based optimisation of surveillance allocations (see Step 6)



Select “Save” if enabled (note that data file selection may autosave your selections).

2. Spatial locations division type

- **Region CSV (Required):** Locations or patches may be defined via a CSV table of location coordinates in longitude and latitude (WGS84) with explicitly named columns 'lon' and 'lat'. For convenience, additional columns for other model parameters may also be included in this CSV file
- **Occurrence probability (Required):** Probability values to represent the likelihood of invasive species occurrence at each region spatial location. Also:
 - Select the checkbox “Use column 'establish_pr' included in Region CSV” if the column has been included in the Region CSV, or define it separately by selecting another CSV file having aligned 'lon', 'lat', and 'establish_pr' columns
 - Specify via the “Relative probability” checkbox (as per OPTION 1) if the probabilities are actual (unchecked) or relative (checked). Note that actual probabilities are required for cost-based or system-wide sensitivity-based optimisation of surveillance resource allocation (see Step 6)

Workflows | My Projects > Surveillance Design | Environment

last update: 5 Feb 2026 | Manage | (X) Input Parameters | Info [debug]

Determine where to allocate resources

- Surveillance
- Design Method
- Discrete Sampling
- Environment**
- REGION CSV patch 4s
- (X) Parameters
- Allocation
- Surveillance Design
- My Exported Results

Division type *
Define the type of surveillance resource allocation divisions to be used:

Spatial locations

Region CSV *
Locations or patches may be defined via a CSV table of location coordinates in longitude and latitude (WGS84) with explicitly named columns 'lon' and 'lat', as well as an optional location 'name'. For convenience, additional columns for discrete sampling model parameters and optimisation or existing allocation configuration may also be included in this CSV file

patch 4s

Modify | View

Occurrence probability *
Probability values to represent the likelihood of pest occurrence or establishment at each spatial location

Select the following to use occurrence probability column 'establish_pr' if included in the Region CSV. Deselect to assign separate occurrence probability values (below)

Use column 'establish_pr' included in Region CSV

Indicates if occurrence probabilities are relative (default).
Uncheck if actual probabilities are provided. Note that actual

Save | Reset

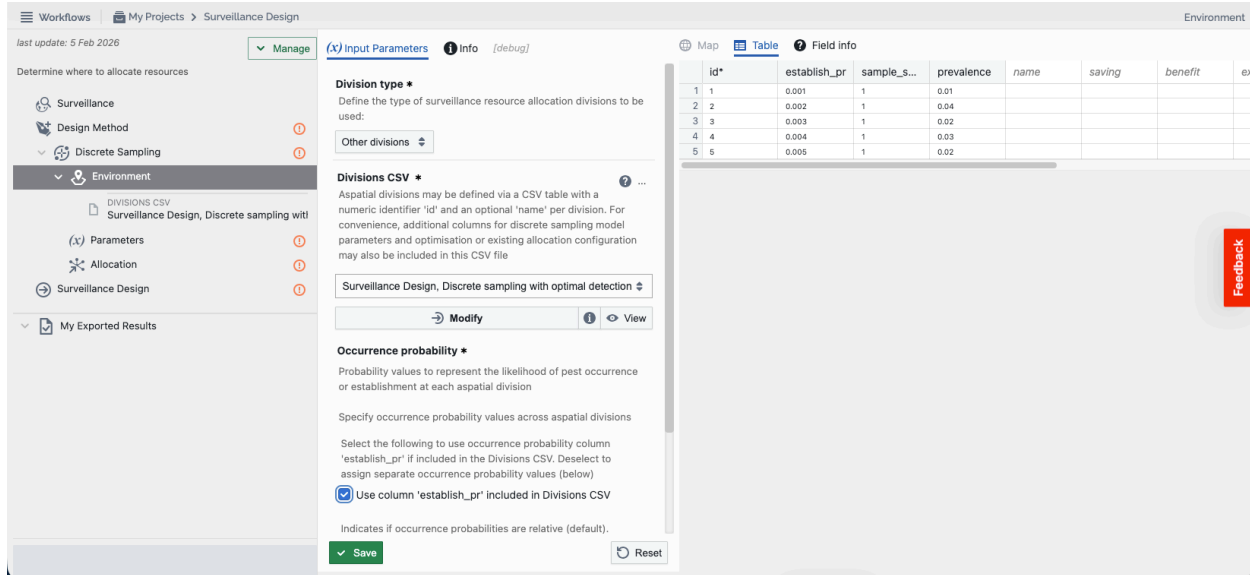
	lat*	lon*	name	establish_pr	sample_s...	total_indiv	prevalence
1	-37.8	144.9	Melbourne	0.95	0.8	500	0.0001
2	-38.2	144.3	Geelong	0.85	0.8	100	0.0001
3	-37.6	143.9	Ballarat	0.75	0.8	150	0.0001
4	-36.8	144.3	Bendigo	0.7	0.8	80	0.0001
5	-38.4	142.5	Warrnambool	0.8	0.8	70	0.0001
6	-38.1	147.1	Sale	0.94	0.7	65	0.0001
7	-36.4	145.5	Shepparton	0.55	0.8	50	0.0001
8	-38.3	141.5	Portland	0.72	0.9	60	0.0001
9	-37.7	148.4	Orbost	0.76	0.8	75	0.0001
10	-36.6	146	Benalla	0.5	0.7	110	0.0001
11	-36.1	146.9	Albury	0.6	0.8	140	0.0001
12	-36.7	142.2	Horsham	0.4	0.9	85	0.0001
13	-34.2	142.2	Mildura	0.3	0.8	90	0.0001
14	-37.8	142	Hamilton	0.7	0.8	60	0.0001

Feedback

Select “Save” if enabled (note that data file selection may autosave your selections).

3. Other divisions type

- **Divisions CSV (Required):** Other/aspatial divisions may be defined via a CSV table with a numeric identifier 'id' per division. For convenience, additional columns for other model parameters may also be included in this CSV file
- **Occurrence probability (Required):** Probability values to represent the likelihood of invasive species occurrence at each aspatial division. Also:
 - Select the checkbox “Use column 'establish_pr' included in Divisions CSV” if the column has been included in the Divisions CSV, or define it separately by selecting another CSV file having aligned 'id' and 'establish_pr' columns
 - Specify via the “Relative probability” checkbox (as per OPTION 1) if the probabilities are actual (unchecked) or relative (checked). Note that actual probabilities are required for cost-based or system-wide sensitivity-based optimisation of surveillance resource allocation (see Step 6)



Select “Save” if enabled (note that data file selection may autosave your selections).

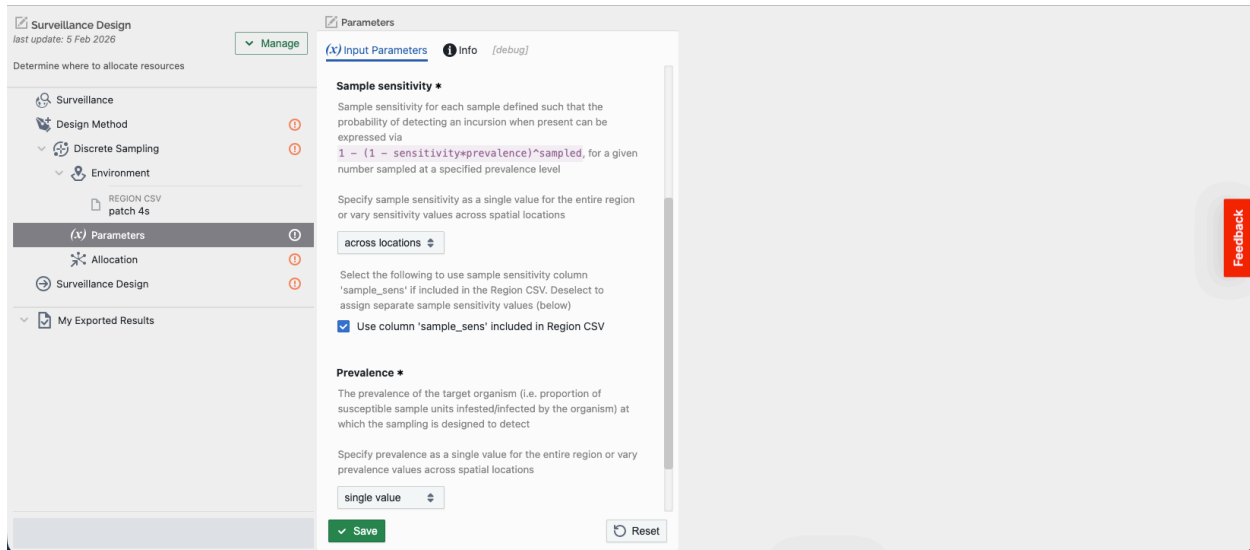
Step 5. Specify the parameters

Select the “Parameters” section under the chosen surveillance method to define the parameters specific to the surveillance method. Dependent on the design method users specified in Step 3, either:

1. Discrete Sampling

- **Total sample units** (*Required*): Total number of susceptible units, such as individual plants or animals, collectives (e.g. herds, nests, etc.), or partitioned areas of susceptible organisms (e.g. orchards, plots, paddocks, farms, enclosures, etc.), available for sampling at each spatial location or other/aspatial division (if known). Firstly, select:
 - Indication of whether the total individuals are ‘known’ or ‘unknown’
 - If ‘known’ the total individual values at each location or division may be defined, dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘total_indiv’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘total_indiv’ columns
 - Other divisions – either select the checkbox “Use column ‘total_indiv’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘total_indiv’ columns

- If 'unknown' the total individual values are not required, which assumes that $\leq 10\%$ of total individuals are sampled
- **Sample sensitivity** (*Required*): Probability of detection (given threat presence) for each sample. This is defined such that the probability of detecting an incursion when present within a spatial location or aspatial division can be expressed via:
 - $1 - (1 - \text{sensitivity} * \text{sampled} / \text{total})^{(\text{prevalence} * \text{total})}$
(when total individuals is 'known')
 - $1 - (1 - \text{sensitivity} * \text{prevalence})^{\text{sampled}}$
(when total individuals is 'unknown' and assuming $\leq 10\%$ sampled)
 for given number sampled at a specified prevalence level. Specify either:
 - As a 'single value' for the entire study
 - Vary values 'across locations' (raster or point) or 'across divisions' (aspatial), defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column 'sample_sens' when included in Region CSV”, or define it separately by selecting another CSV file having aligned 'lon', 'lat', and 'sample_sens' columns
 - Other divisions – either select the checkbox “Use column 'sample_sens' when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned 'id' and 'sample_sens' columns
- **Prevalence** (*Required*): The prevalence of the target organism, or the proportion of individuals infected, at which the sampling is designed to detect. This is used in defining the probability of detecting an incursion when present (as per sample sensitivity above). Specify either:
 - As a 'single value' for the entire study
 - Vary values 'across locations' (raster or point) or 'across divisions' (aspatial), defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column 'prevalence' when included in Region CSV”, or define it separately by selecting another CSV file having aligned 'lon', 'lat', and 'prevalence' columns
 - Other divisions – either select the checkbox “Use column 'prevalence' when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned 'id' and 'prevalence' columns



Select “Save” if enabled (note that data file selection may autosave your selections).

2. Continuous Surveillance

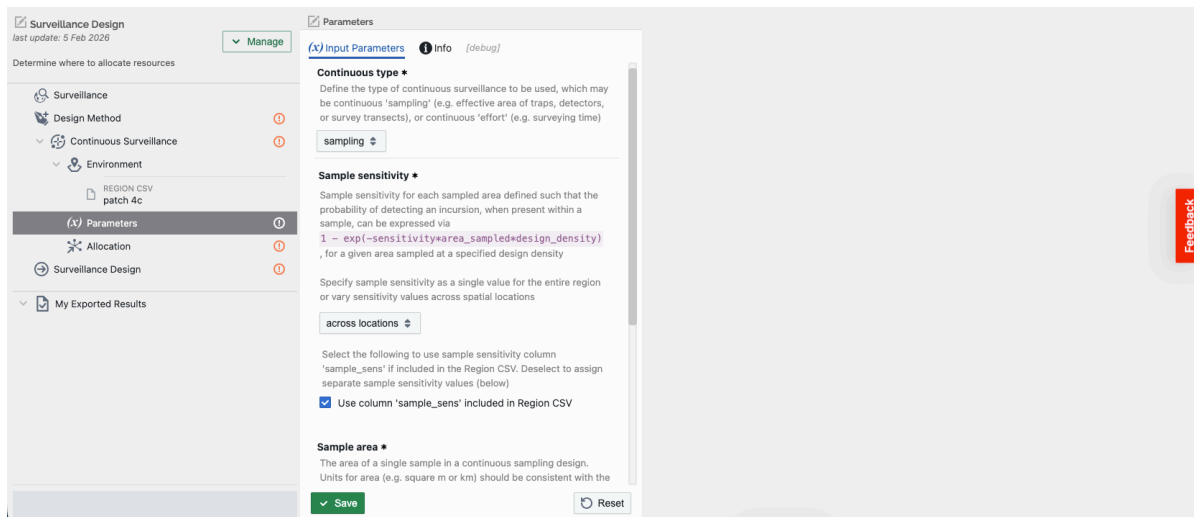
- **Continuous type** (*Required*): The type of continuous surveillance to be used, select either:
 - Continuous area 'sampling' (e.g. effective area of traps, detectors, or survey transects)
 - Continuous 'effort' (e.g. surveying time)

The parameters that follow are dependent on the continuous type selected.

2.1. Continuous area sampling

- **Sample sensitivity** (*Required*): Probability of detection (given threat presence) for each sampled. This is defined such that the probability of detecting an incursion when present within a spatial location or aspatial division can be expressed via:
 - **$1 - \exp(-\text{sensitivity} * \text{area_sampled} * \text{design_density})$** for a given area sampled at a specified design density. Specify either:
 - As a ‘single value’ for the entire study
 - Vary values ‘across locations’ (raster or point) or ‘across divisions’ (aspatial), defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘sample_sens’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘sample_sens’ columns

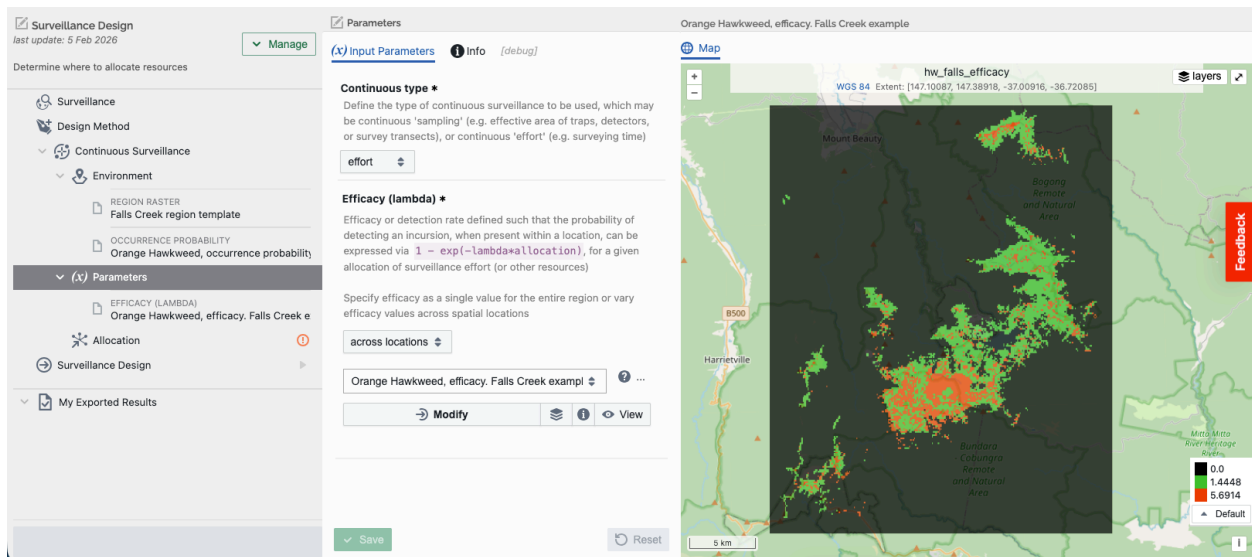
- Other divisions – either select the checkbox “Use column ‘sample_sens’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘sample_sens’ columns
- **Sample area** (*Required*): The area of a single sample in a continuous sampling design. Units for area (e.g. m² or km²) should be consistent with the design density (below). Note that when set to 1 (default), the total number of samples will be equivalent to the total area sampled
- **Design density** (*Required*): The density of the target organism at which the continuous sampling is designed to detect. This is used in defining the probability of detecting an incursion when present (as per sample sensitivity above). Specify either:
 - As a ‘single value’ for the entire study
 - Vary values ‘across locations’ (raster or point) or ‘across divisions’ (aspatial), defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘design_dens’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘design_dens’ columns
 - Other divisions – either select the checkbox “Use column ‘design_dens’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘design_dens’ columns



Select “Save” if enabled (note that data file selection may autosave your selections).

2.2. Continuous effort

- **Efficacy (lambda) (Required):** Efficacy or detection rate defined such that the probability of detecting an incursion, when present within a spatial location or aspatial division, can be expressed:
 - **$1 - \exp(-\lambda \cdot \text{allocation})$**for a given allocation of surveillance effort (or other resources). Specify either:
 - As a 'single value' for the entire study
 - Vary values 'across locations' (raster or point) or 'across divisions' (aspatial), defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘lambda’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘lambda’ columns
 - Other divisions – either select the checkbox “Use column ‘lambda’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘lambda’ columns



Select “Save” if enabled (note that data file selection may autosave your selections).

Step 6. Specify the allocation

Select the “Allocation” section under the chosen surveillance method to define how effective surveillance resources are allocated, via optimisation approaches given chosen objectives (e.g. minimum total cost), constraints (e.g. total budget), and other optional parameters (e.g. fixed costs). Alternatively, existing resource allocations may be analysed (i.e. sensitivities calculated). Users then specify:

- **Allocation design (Required):** Defines the surveillance resource allocation design to be used via selection:

- Optimisation – find an effective allocation of surveillance resources
- Existing – calculate sensitivities for an existing surveillance design

Subsequent parameters in the allocation section are configured differently dependent on the allocation design selected (optimisation or existing).

1. Optimisation

Optimisation parameters are made available after specifying:

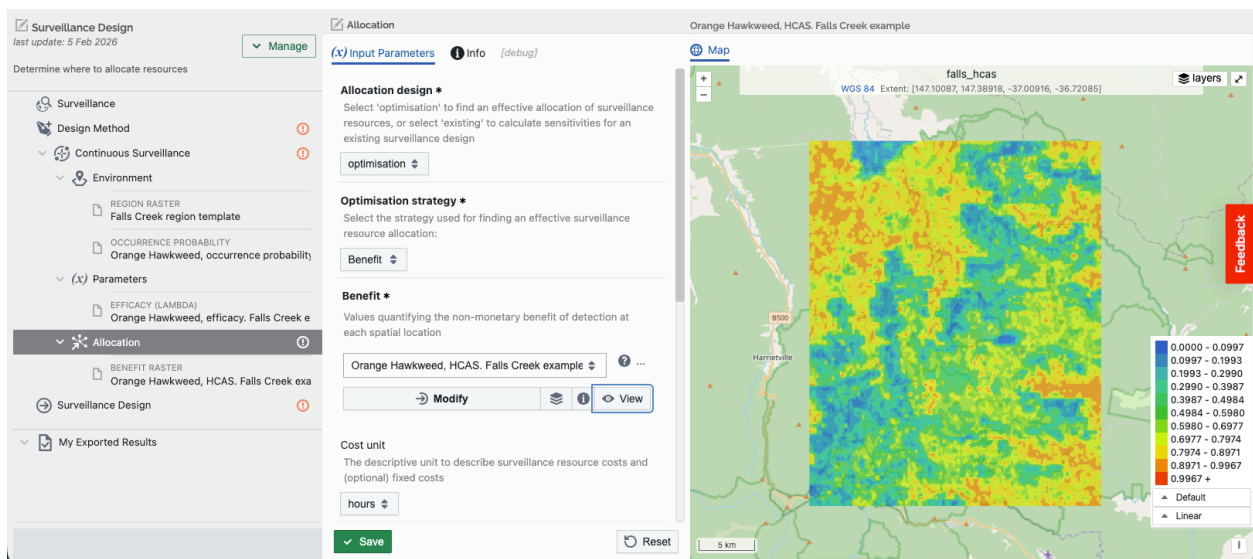
- **Optimisation strategy** (*Required*): The strategy used for finding an effective surveillance resource allocation via selection:
 - Cost – minimise total surveillance and incursion management costs
 - Saving – maximise total monetary saving (or cost-dependent benefit)
 - Benefit – maximise total non-monetary benefit
 - Detections – maximise the total number of detections
 - Sensitivity – maximise the overall system-wide sensitivity (detection probability)

Note that the cost-based options (cost and savings) and the system-wide sensitivity option will only be available when actual occurrence probabilities are provided in Step 4, that is the “Relative probability” checkbox is unchecked.

- **Management cost** (*Required for ‘cost’ optimisation*): Represents estimated management costs for when the incursion is detected and undetected, which are configured via entries:
 - **Detected** (*Required*)
 - **Undetected** (*Required*)
- **Saving** (*Required for ‘saving’ optimisation*): Values quantifying the monetary saving (or cost-dependent benefit) of detection at each spatial location or aspatial division, defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘saving’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘saving’ columns
 - Other divisions – either select the checkbox “Use column ‘saving’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘saving’ columns
- **Benefit** (*Required for ‘cost’ optimisation*): Values quantifying the non-monetary benefit of detection at each spatial location or aspatial division, defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘benefit’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘benefit’ columns

- Other divisions – either select the checkbox “Use column ‘benefit’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘benefit’ columns
- **Cost unit** (*Required for ‘cost’ or ‘saving’ optimisation*): The unit to describe surveillance, management, saving, and/or optional fixed costs (e.g. \$, hours)
- **Sample cost** (*Required for ‘cost’ or ‘saving’ optimisation, or if a cost unit is defined*): Either the cost per:
 - sample when discrete sampling selected in Step 3
 - sample area when continuous surveillance selected in Step 3 and continuous area sampling selected in Step 5
- **Allocated surveillance cost** (*Required for ‘cost’ or ‘saving’ optimisation, or if a cost unit is defined*): The cost per unit of allocated surveillance when continuous surveillance selected in Step 3 and continuous effort selected in Step 5
- **Fixed cost** (*Optional when cost unit is defined*): Fixed additional cost applied to allocated locations or aspatial divisions (e.g. travel cost). Specify either:
 - As a ‘single value’ for the entire study
 - Vary values ‘across locations’ (raster or point) or ‘across divisions’ (aspatial), defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘fixed_cost’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘fixed_cost’ columns
 - Other divisions – either select the checkbox “Use column ‘fixed_cost’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘fixed_cost’ columns
- **Existing sensitivity** (*Optional*): Existing surveillance sensitivity (detection probability) at each spatial location or aspatial division. Useful for representing estimated general surveillance sensitivity. Defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF)
 - Spatial locations – either select the checkbox “Use column ‘exist_sens’ when included in Region CSV”, or define it separately by selecting another CSV file having aligned ‘lon’, ‘lat’, and ‘exist_sens’ columns
 - Other divisions – either select the checkbox “Use column ‘exist_sens’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned ‘id’ and ‘exist_sens’ columns
- **Constraint** (*Required*): The constraint for the resource allocation. Select:

- None – optimal balance between allocation costs and management costs or savings (only available for optimal cost or saving optimisation)
- Budget - total budget constraint, either:
 - cost-based budget when cost unit is defined
 - resource-based budget when cost unit is undefined
- Sensitivity – desired overall system-wide sensitivity or detection probability
- **Total budget** (*Required when ‘budget’ constraint selected*): The total cost-based or resource-based budget (as indicated or defined by the cost unit)
- **System sensitivity** (*Required when ‘sensitivity’ constraint selected*): The desired (minimum) system-wide sensitivity or detection probability of the surveillance design (e.g. 0.95)
- **Discrete Allocation** (*Optional*): Checkbox to indicate allocation should be whole numbers (e.g. traps, samples)
- **Minimum Allocation** (*Optional*): Minimum permissible allocation quantity (*avoids infeasibly small allocations to locations*)



Select “Save” if enabled (note that data file selection may autosave your selections).

2. Existing

- **Existing allocation** (*Required*): Existing surveillance resource quantities allocated to spatial locations or aspatial divisions. Temporal allocations may be configured via multi-layered rasters or via additional columns in point-based or aspatial CSV files. Defined dependent on the division type selected in Step 4:
 - Raster grid (GeoTIFF) – multi-layer for temporal allocations
 - Spatial locations – either select the checkbox “Use column ‘exist_alloc*’ when included in Region CSV”, or define it separately by selecting another

CSV file having aligned columns for 'lon', 'lat', and 'exist_alloc' (or 'exist_alloc_1', 'exist_alloc_2', etc., when temporal)

- Other divisions – either select the checkbox “Use column ‘exist_alloc*’ when included in Divisions CSV”, or define it separately by selecting another CSV file having aligned columns for 'id' and 'exist_alloc' (or 'exist_alloc_1', 'exist_alloc_2', etc., when temporal)
- **Time unit (Optional):** The descriptive unit to describe surveillance time intervals when existing allocation is (optionally) temporal. Select from:
 - Years
 - Months
 - Weeks
 - Days
 - Hours

	lat*	lon*	name	establish_pr	exist_alloc_1	exist_alloc_2	exist_alloc_3
1	-38.4	142.5	Warrnambool	0.8	15	14	13
2	-38.3	141.5	Portland	0.72	6	5	5
3	-38.2	144.3	Geelong	0.85	30	27	24
4	-38.1	147.1	Sale	0.94	10	9	8
5	-37.8	144.9	Melbourne	0.95	100	90	81
6	-37.8	142	Hamilton	0.7	7	6	5
7	-37.7	148.4	Orbost	0.76	7	6	5
8	-37.6	143.9	Ballarat	0.75	20	18	16
9	-36.8	144.3	Bendigo	0.7	20	18	16
10	-36.7	142.2	Horsham	0.4	5	5	5
11	-36.6	146	Benalla	0.5	8	7	6
12	-36.4	145.5	Shepparton	0.55	8	7	6
13	-36.1	146.9	Albury	0.6	12	11	10
14	-34.2	142.2	Mildura	0.3	9	8	7

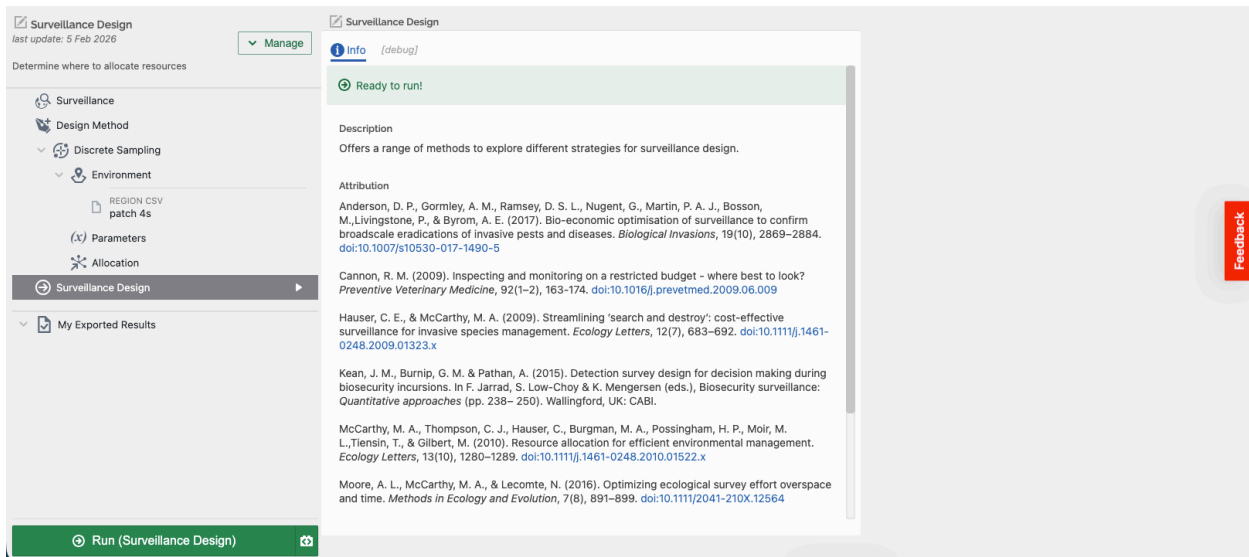
Select “Save” if enabled (note that data file selection may autosave your selections).

Step 7. Run the surveillance design

Once the Surveillance and Design Method branches and subbranches have been successfully configured you will be able to run your Surveillance Design, which will either:

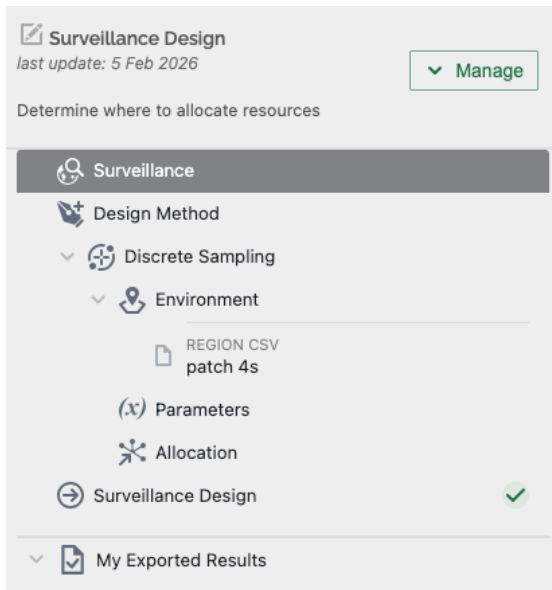
- Find an effective allocation across spatial locations or aspatial divisions using the optimisation strategy, constraints, and other parameters configured in Step 6, and calculate the sensitivity (detection probability) for this allocation
- Calculate the sensitivity (detection probability) across spatial locations or aspatial divisions, as well as an overall system-wide sensitivity, for an existing

surveillance resource allocation configured in Step 6. This may also be performed for temporal values when provided



Click the 'Run' button in the bottom left to run your project. The output page will be updated as the job progresses from "Created", "Submitted", "Started" and "Success".

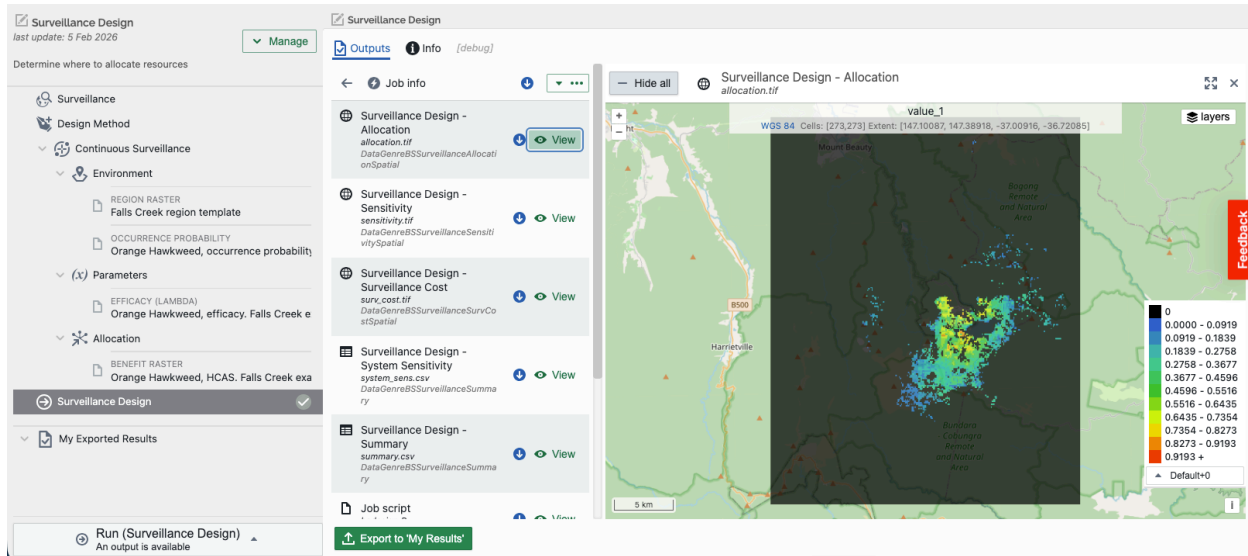
Once it has finished, a green tick will appear next to Surveillance Design.



The model surveillance allocation output may be displayed as a viewable allocation in the output pane. The outputs provided depend on the design method and the environment region type selected by the user.

1. Optimal raster output

For optimal raster-based spatial surveillance designs the outputs will be presented, including maps of the spatial allocations, sensitivities, costs (when applicable), and other files.



Users can zoom in or out of regions of interest. Interactive maps also allow users to change the type of legend displayed.

Clicking on the buttons allows users to view and download the outputs.

These optimal raster-based surveillance design outputs include:

- **Surveillance Design – Allocation** – A GeoTIFF containing the quantity of allocated surveillance resources across geographic space
- **Surveillance Design – Sensitivity** – A GeoTIFF of probabilities of detection given surveillance allocation. This file may be used to configure surveillance (or detection action) sensitivities within a Population Spread Model workflow
- **Surveillance Design – Allocation Sensitivity** – A GeoTIFF of probabilities of detection given surveillance allocation only, which is only present when optionally existing sensitivities are also specified
- **Surveillance Design – Surveillance Cost** – A GeoTIFF of surveillance costs given surveillance allocation (when costs are provided in the allocation parameters). This file may be used to configure surveillance (or detection action) costs within a Population Spread Model workflow
- **Surveillance Design – System Sensitivity** – A CSV file containing columns 'interval' (temporal index) and value for system-wide sensitivity ('pr_detect'). This file may be used as an input for the Proof of Freedom workflow via saved results (see Step 8 for example)

- **Surveillance Design – Summary** – A CSV file containing summary information across the entire study regions, such as total allocation, total management & overall costs (when applicable), and system-wide sensitivity
- **Job script** – A copy of the R script used to build the risk map
- **Log file** – A text file containing processes, messages, and other details associated with model runs
- **Metadata** – A .json file containing the metadata required to run the model on Biosecurity Commons
- **Input parameters** – Input parameters required to run the Job Script

2. Optimal CSV output

For spatial locations (point-based) or other division (aspatial) optimal surveillance designs the outputs will include a table with the generated surveillance allocations and their corresponding sensitivity and surveillance costs (when applicable) for each spatial location or aspatial division appended to columns provided when defining the environment region or divisions.

The screenshot shows the 'Surveillance Design' interface. On the left is a navigation menu with categories like 'Design Method', 'Environment', 'Parameters', and 'Allocation'. The 'Allocation' section is active. The main area displays a list of outputs with 'View' buttons. A 'Table' view is selected, showing a table with columns: saving, exist_alloc, allocation, sensitivity, and surv_cost. The table contains 15 rows of data. A 'Feedback' button is visible on the right side of the table.

	saving	exist_alloc	allocation	sensitivity	surv_cost
1	10	100	204	0.805741013108707	10.2
2	5	30	104	0.56627550936983	5.2
3	5	20	94	0.530000730973891	4.7
4	5	20	89	0.5107410180277	4.45
5	3	15	65	0.406721390811311	3.25
6	2	10	48	0.286220734909451	2.4
7	2	8	31	0.220417939376928	1.55
8	2	6	45	0.334244976936322	2.25
9	2	7	43	0.292051114122131	2.15
10	2	8	24	0.155145417784487	1.2
11	5	12	79	0.469821514526302	3.95
12	2	5	24	0.195052218727108	1.2
13	4	9	35	0.245066799196479	1.75
14	3	7	58	0.37240859826072	2.9
15					

Clicking on the buttons allows users to view and download the outputs.

These optimal CSV-based surveillance design outputs include:

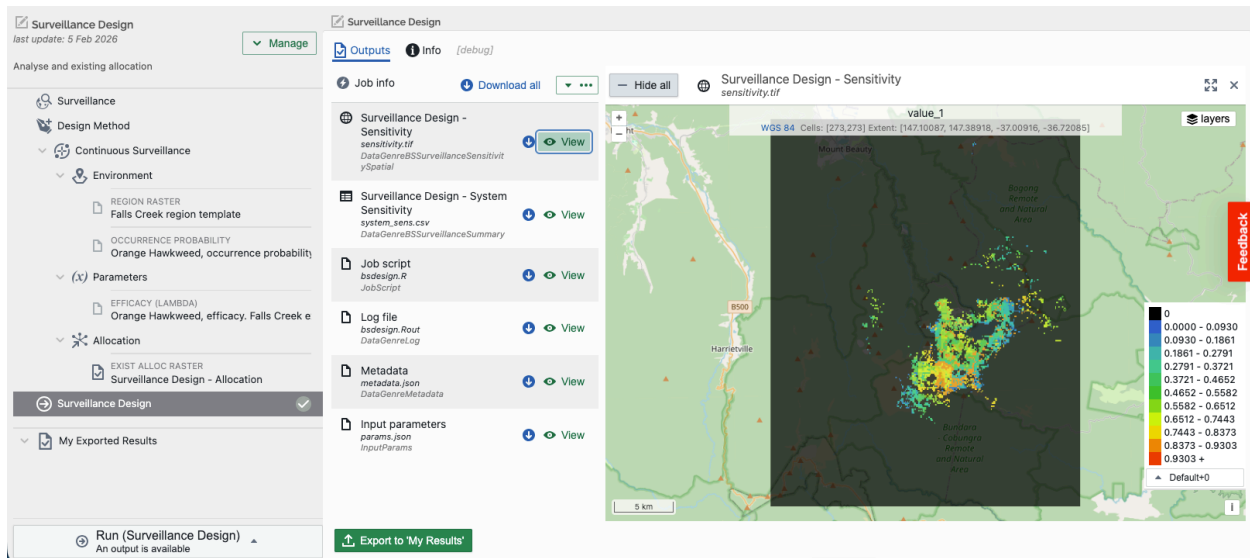
- **Surveillance Design** – A CSV containing generated surveillance allocations, the (overall) sensitivities, the sensitivities associated with the allocation only when existing sensitivities are provided, as well as surveillance costs (when costs are provided in the allocation parameters) for each spatial location or aspatial division appended to columns provided when defining the environment region or

divisions. This file may be used to configure surveillance (or detection action) sensitivities and/or costs within a Population Spread Model workflow

- **Surveillance Design – System Sensitivity** – A CSV file containing columns ‘interval’ (temporal index) and value for system-wide sensitivity (‘pr_detect’). This file may be used as an input for the Proof of Freedom workflow via saved results (see Step 8 for example)
- **Surveillance Design – Summary** – A CSV file containing summary information across the entire study regions, such as total allocation, total management & overall costs (when applicable), and system-wide sensitivity
- **Job script** – A copy of the R script used to build the risk map
- **Log file** – A text file containing processes, messages, and other details associated with model runs
- **Metadata** – A .json file containing the metadata required to run the model on Biosecurity Commons
- **Input parameters** – Input parameters required to run the Job Script

3. Existing raster output

For existing raster-based spatial surveillance designs the output will present a map of the generated sensitivities corresponding to each (optionally temporal) existing allocation.



Clicking on the buttons allows users to view and download the outputs.

These existing raster-based surveillance design outputs include:

- **Surveillance Design – Sensitivity** – A GeoTIFF of probabilities of detection given existing surveillance allocation. When existing allocations were defined temporally via multiple raster layers, a corresponding sensitivity raster will be

generated for each existing layer. This/these file/s may be used to configure surveillance (or detection action) sensitivities within a Population Spread Model workflow

- **Surveillance Design – System Sensitivity** – A CSV file containing columns ‘interval’ (temporal index) and value for system-wide sensitivity (‘pr_detect’). This file may be used as an input for the Proof of Freedom workflow via saved results (see Step 8 for example)
- **Job script** – A copy of the R script used to build the risk map
- **Log file** – A text file containing processes, messages, and other details associated with model runs
- **Metadata** – A .json file containing the metadata required to run the model on Biosecurity Commons
- **Input parameters** (*All models*): Input parameters required to run the Job Script

4. Existing CSV output

For existing point-based or aspatial surveillance designs the output will present a table with the generated sensitivities corresponding to each (optionally temporal) existing allocation for each spatial location or aspatial division appended to columns provided when defining the environment region or divisions.

The screenshot displays the 'Surveillance Design' interface. On the left is a sidebar with a 'Manage' button and a list of design components: 'Design Method', 'Discrete Sampling', 'Environment' (with sub-items 'REGION CSV patch 4s w exist' and 'EXIST ALLOC DATA patch 4s w exist'), 'Parameters', and 'Allocation'. Below this is 'My Exported Results'. The main area shows 'Job Info' and a list of outputs with 'View' buttons: 'Surveillance Design - design.csv', 'Surveillance Design - System Sensitivity - system_sens.csv', 'Job script - bsdesign.R JobScript', 'Log file - bsdesign.Rout DataGenResLog', 'Metadata - metadata.json DataGenResMetadata', and 'Input parameters - params.json InputParams'. A table titled 'Surveillance Design design.csv' is shown in 'Table' view, displaying 15 rows of data with columns: exist_alloc_2, exist_alloc_3, sensitivity_1, sensitivity_2, and sensitivity_3. A 'Feedback' button is on the right side of the table.

	exist_alloc_2	exist_alloc_3	sensitivity_1	sensitivity_2	sensitivity_3
1	90	81	0.504635534644148	0.468586767268683	0.433905248829165
2	27	24	0.190014107479704	0.172763460172549	0.155145417784487
3	18	16	0.131069643233774	0.118775682784298	0.10630778266019
4	18	16	0.131069643233774	0.118775682784298	0.10630778266019
5	14	13	0.10000783752285	0.0936634818961233	0.087274402715129
6	9	8	0.0678356600007564	0.0612645115818291	0.05464704086790
7	7	6	0.05464704086790...	0.0479829213171243	0.041271824085724
8	5	5	0.0412718240857244	0.0345134180118071	0.034513418011807
9	6	5	0.0479829213171243	0.0412718240857244	0.034513418011807
10	7	6	0.05464704086790...	0.0479829213171243	0.0412718240857244
11	11	10	0.08084028470808...	0.074360810380751	0.0678356600007564
12	5	5	0.0345134180118071	0.0345134180118071	0.0345134180118071
13	8	7	0.0612645115818291	0.05464704086790...	0.0479829213171243
14	6	5	0.0479829213171243	0.0412718240857244	0.0345134180118071
15					

Clicking on the buttons allows users to view and download the outputs.

These existing CSV-based surveillance design outputs include:

- **Surveillance Design** – A CSV containing generated sensitivity corresponding to each (optionally temporal) existing allocation for each spatial location or aspatial division appended to columns provided when defining the environment region or divisions. This file may be used to configure surveillance (or detection action) sensitivities within a Population Spread Model workflow

- **Surveillance Design – System Sensitivity** – A CSV file containing columns ‘interval’ (temporal index) and value for system sensitivity (‘pr_detect’). This file may be used as an input for the Proof of Freedom workflow via saved results (see Step 8 for example)
- **Job script** – A copy of the R script used to build the risk map
- **Log file** – A text file containing processes, messages, and other details associated with model runs
- **Metadata** – A .json file containing the metadata required to run the model on Biosecurity Commons
- **Input parameters** – Input parameters required to run the Job Script

Step 8. Exporting outputs for use in other workflows

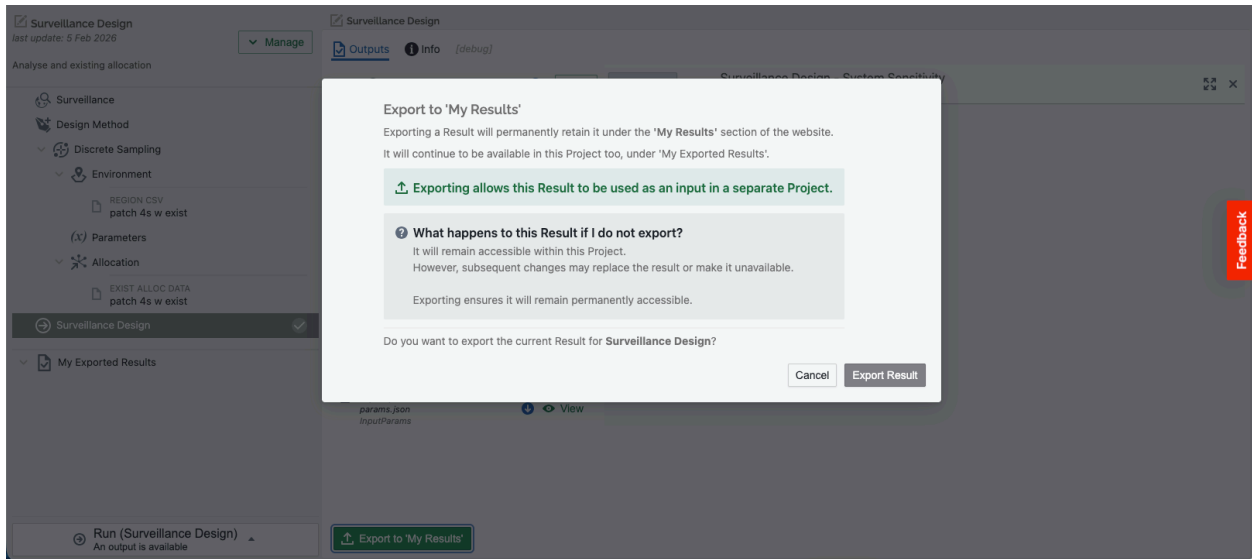
Users may wish to export outputs for use in other projects or other workflows. For example, the system sensitivity CSV file produced by a surveillance design may be used as an input for the Proof of Freedom workflow.

To do this select “Export to My Results” in the bottom left corner of the output display.

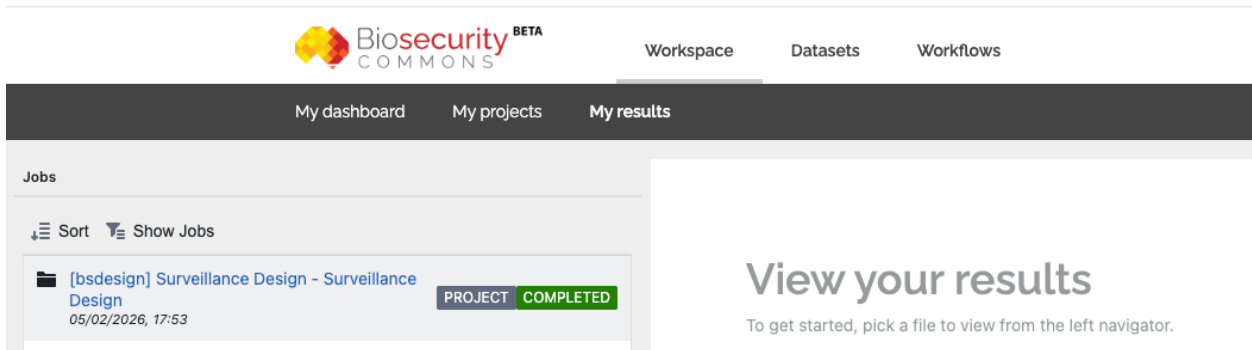
The screenshot shows the Biosecurity Commons interface for a 'Surveillance Design' workflow. The left sidebar contains navigation options like 'Design Method', 'Discrete Sampling', 'Environment', 'Parameters', and 'Allocation'. The central panel lists several outputs, including 'Surveillance Design - System Sensitivity' (system_sens.csv), 'Job script', 'Log file', 'Metadata', and 'Input parameters'. The right panel displays a table of data for 'system_sens.csv' with columns 'interval' and 'pr_detect'.


interval	pr_detect
1	0.758236579394095
2	0.721586268058533
3	0.682824614314323
4	

At the bottom left of the output display, there is a green button labeled 'Export to My Results'.



This output will now be discoverable in the user's "My results" database, which in turn makes the layer available for use in other workflows.




Workspace
Datasets
Workflows

My dashboard
My projects
My results

Jobs
[bsdesign] Surveillance Design - Surveillance Design
>
[bsdesign] Surveillance Design - Surveillance Design-05-Feb-2026-4:34PM

Job info Share Download all ⋮

- Surveillance Design
design.csv
Download View
- Surveillance Design - System Sensitivity
system_sens.csv
Download View
- Job script
bsdesign.R
Download View
- Log file
bsdesign.Rout
Download View
- Metadata
metadata.json
Download View
- Input parameters
params.json
Download View

Surveillance Design - System Sensitivity
system_sens.csv

	interval	pr_detect
1	1	0.758236579394095
2	2	0.721586268056533
3	3	0.682824614314323
4		

1

For example, within the Proof of Freedom workflow, the system sensitivity result may be utilised as an input (e.g. temporal values for the probability of detection). Refer to the Proof of Freedom support material for further information.

Proof of Freedom
last update: 6 Feb 2026

Manage

Proof of Freedom

- Surveillance System
- Design Method !
- Bayesian freedom design !
- Proof of Freedom !

My Exported Results

Bayesian freedom design

[\(x\) Input Parameters](#) Info [debug]

Detection input *

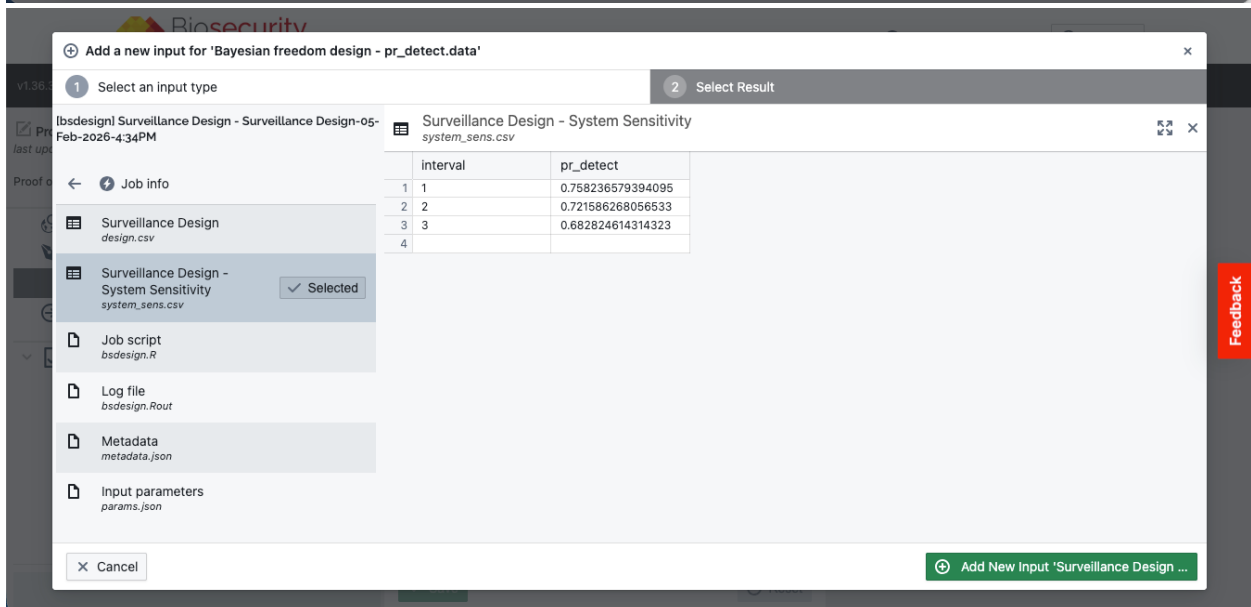
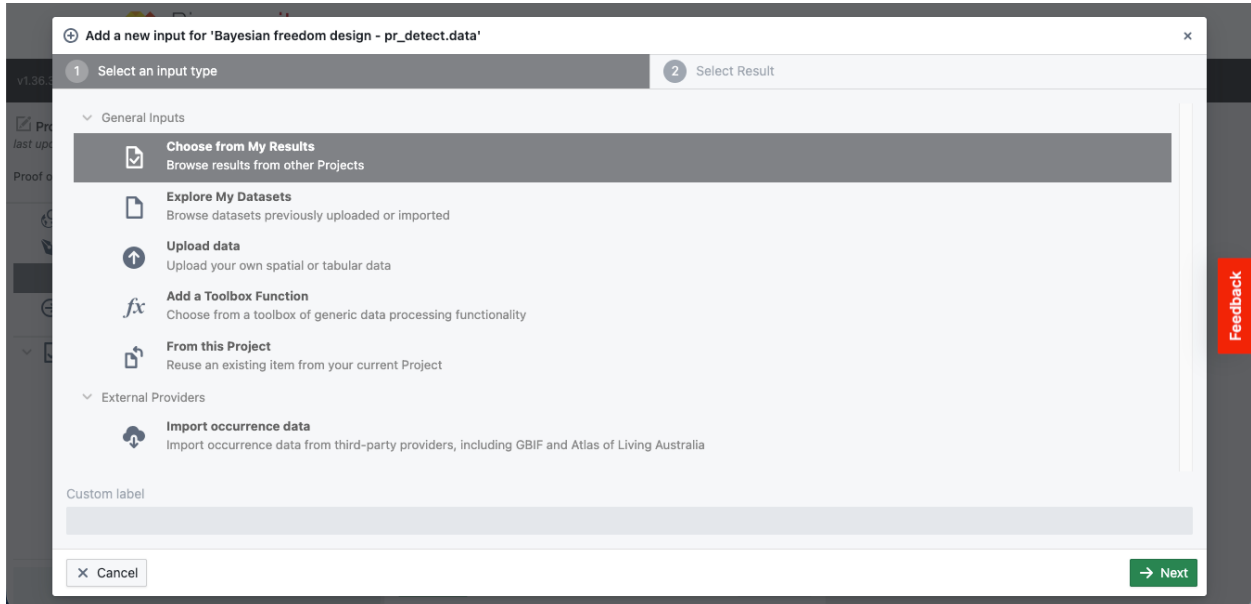
Probability detect *

The probability of detecting the invasive species given its presence. Also known as system sensitivity or detection confidence for a surveillance system. Set a single value or temporal values to change the detection probability across iterations (note that the last value is repeated when iterations exceed length)

+ **Add New Input** ? ...

is a required input

By selecting “Add New Input” then “Choose from My Results”, the desired result may be located and selected.



Feedback

Feedback

Proof of Freedom
last update: 6 Feb 2026

Proof of Freedom

- Surveillance System
- Design Method
- Bayesian freedom design**
- PR_DETECT_DATA
Surveillance Design - System Sensitivity
- Proof of Freedom
- My Exported Results

Bayesian freedom design

Input Parameters Info [debug]

Detection input * detection probability

Probability detect *
The probability of detecting the invasive species given its presence. Also known as system sensitivity or detection confidence for a surveillance system. Set a single value or temporal values to change the detection probability across iterations (note that the last value is repeated when iterations exceed length)

temporal values

Surveillance Design - System Sensitivity

Modify View

Probability persist *

Save Reset

Feedback

Proof of Freedom
last update: 6 Feb 2026

Proof of Freedom

- Surveillance System
- Design Method
- Bayesian freedom design
- PR_DETECT_DATA
Surveillance Design - System Sensitivity**
- Proof of Freedom
- My Exported Results

Surveillance Design - System Sensitivity

Outputs [debug]

All data Surveillance Design - System Sensitivity
system_sens.csv

	interval	pr_detect
1	1	0.758236579394095
2	2	0.721586268056533
3	3	0.682824614314323
4		

Save Remove Input

Feedback