

Seasonal scenarios for Insecticide Resistance Management game. v1

Andy South

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This document demonstrates seasonal scenarios for vector populations and resistance to be used in the game. It follows on from IRM-prototype-game-scenarios4.

The game will modify input parameters to generate reasonable scenarios. The input parameters are simply a means to generate reasonable scenarios.

In the following plots time in days is represented on the x axis, the top panel shows insecticide use, the middle panel shows vector population and the lower panel shows resistance (phenotypic).

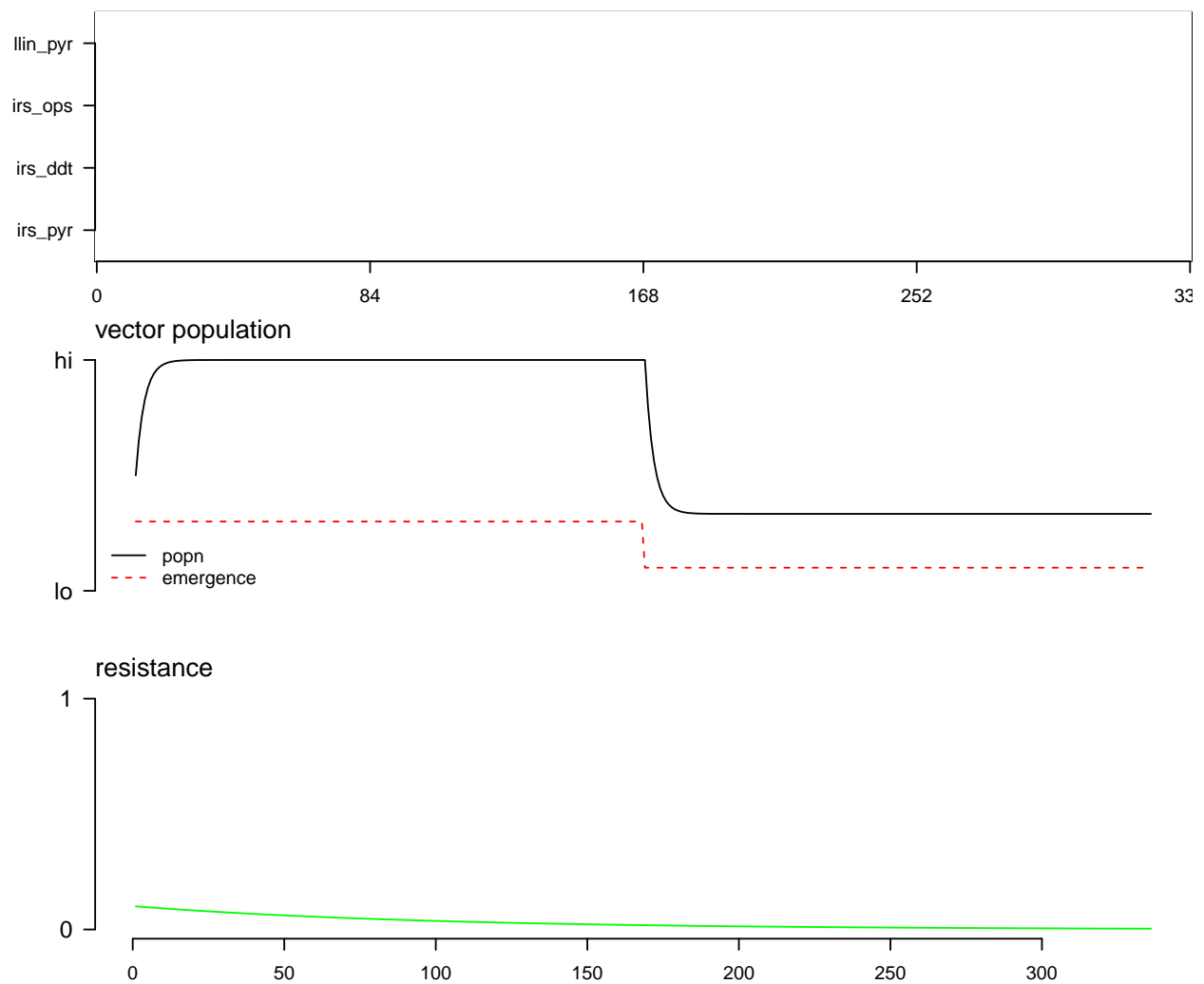
The code included is there merely to show us as developers how the scenarios were generated.

For an interactive version of the equations used to generate these plots see <https://andysouth.shinyapps.io/shinyGame4>.

Remember that years are 336 days (7days * 4weeks * 12months), half=168.

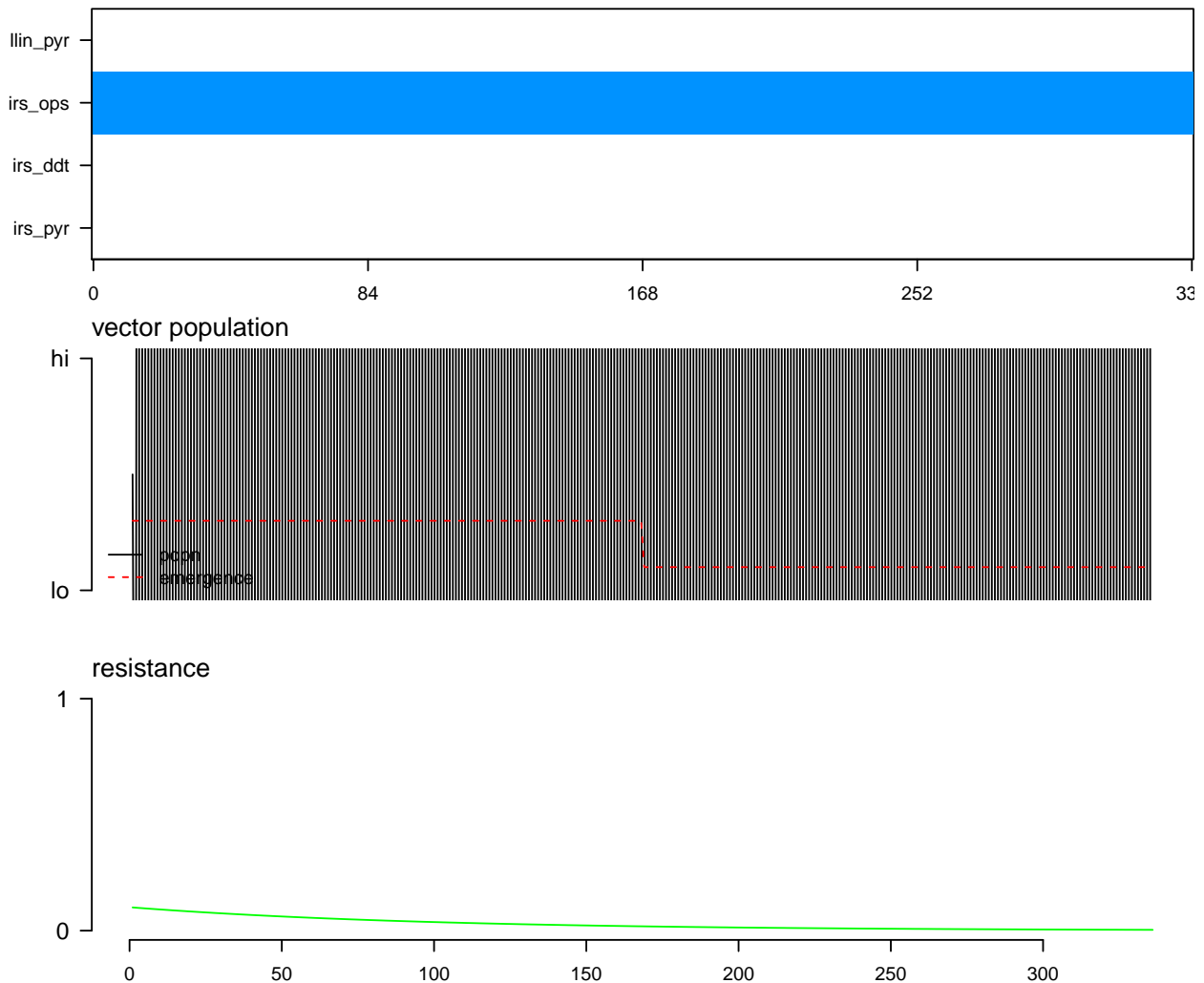
seasonal scenario 1 : 6 months high, 6 months low

```
emergence <- expand_season(season_string="6:0.3;6:0.1")
plot_sim( run_sim(num_tsteps=336, emergence=emergence, survival=0.7,
                 resist_incr=0.02, resist_decr = 0.01),
          plot_emergence=TRUE )
```



seasonal scenario 2 : as previous, with constant control no resistance

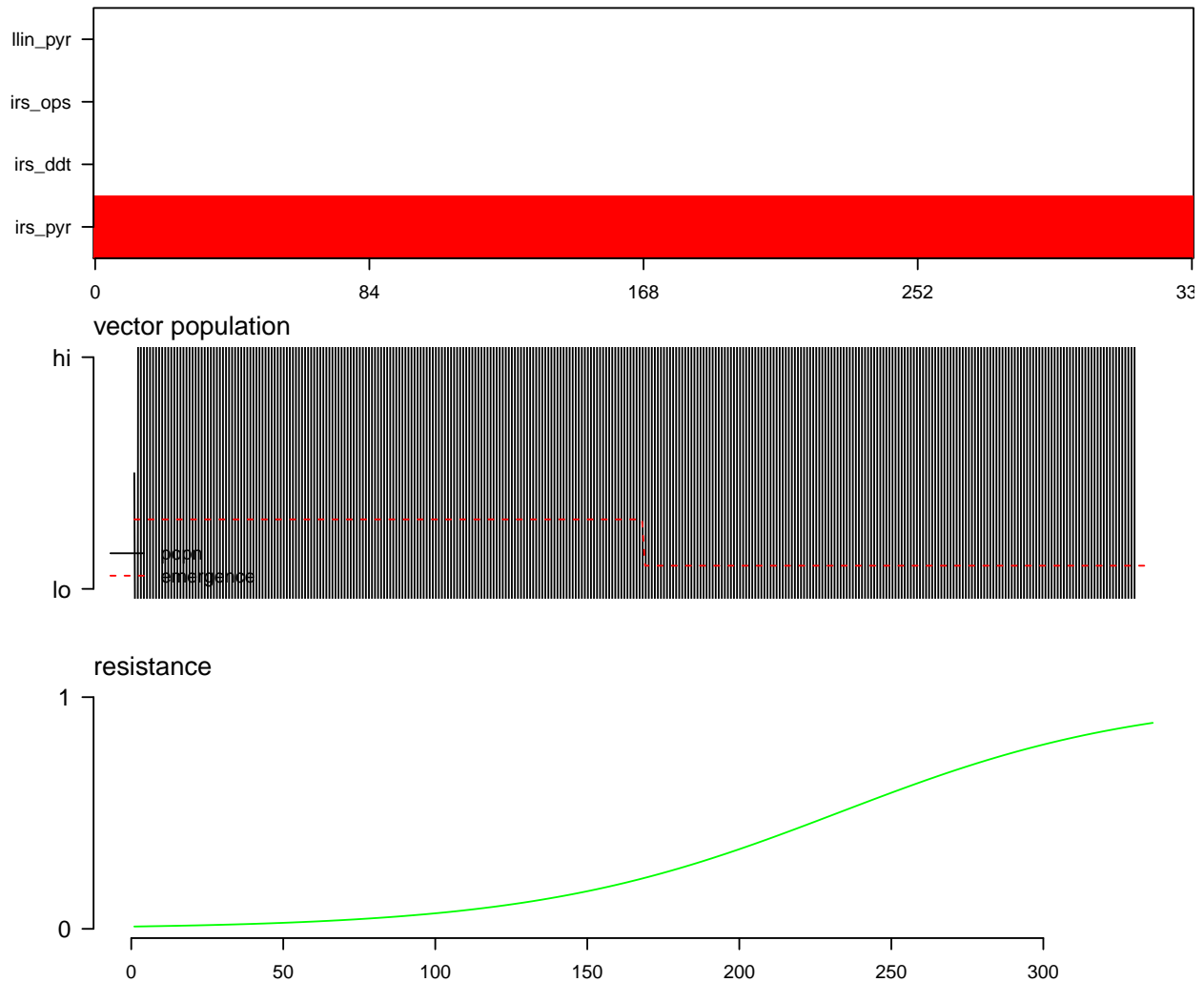
```
emergence <- expand_season(season_string="6:0.3;6:0.1")
l_config <- read_config()
l_config2 <- config_plan(l_config, t_strt=c(1), t_stop=c(336),
                        control_id=c('irs_ops'))
plot_sim( run_sim(l_config=l_config2,
                num_tsteps=336, emergence=emergence, survival=0.7,
                resist_incr=0.02, resist_decr = 0.01),
        plot_emergence=TRUE )
```



seasonal scenario 2 : as previous, with constant control with resistance

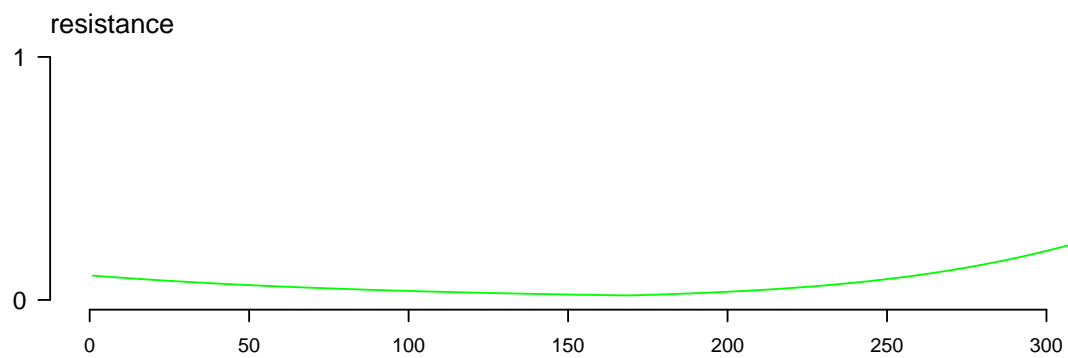
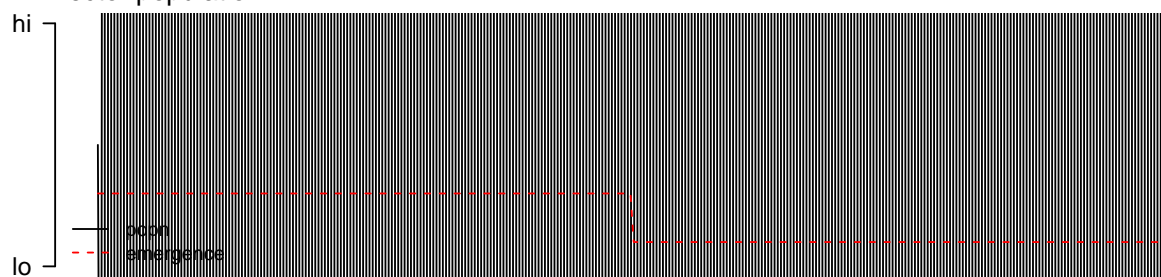
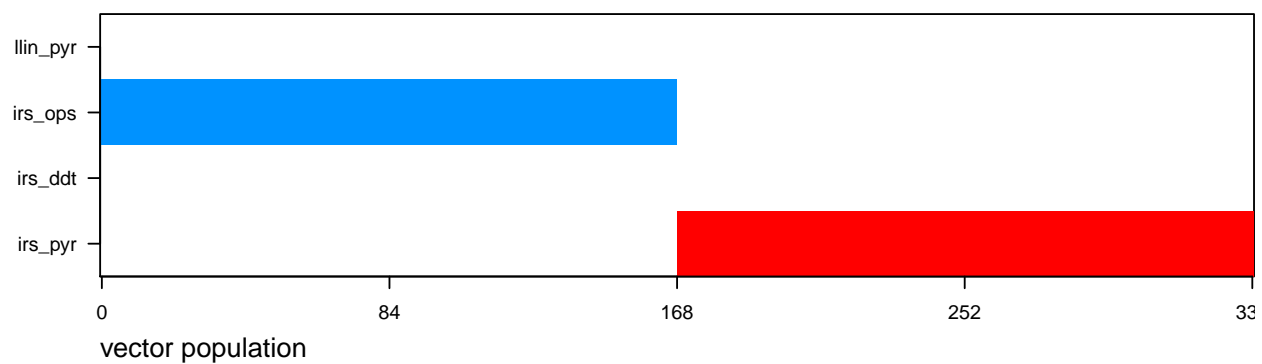
```
emergence <- expand_season(season_string="6:0.3;6:0.1")
l_config2 <- config_plan(l_config, t_strt=c(1), t_stop=c(336),
                        control_id=c('irs_pyr'))
```

```
plot_sim( run_sim(l_config=l_config2,
                 num_tsteps=336, emergence=emergence, survival=0.7,
                 resist_freq_start = 0.01,
                 resist_incr=0.02, resist_decr = 0.01),
          plot_emergence=TRUE )
```



seasonal scenario 3 : as previous, with changing control

```
emergence <- expand_season(season_string="6:0.3;6:0.1")
l_config2 <- config_plan(l_config, t_strt=c(1,169), t_stop=c(168,336),
                        control_id=c('irs_ops','irs_pyr'))
plot_sim( run_sim(l_config=l_config2,
                 num_tsteps=336, emergence=emergence, survival=0.7,
                 resist_incr=0.02, resist_decr = 0.01),
          plot_emergence=TRUE )
```



How controls and resistance mechanisms can be specified.

Our generic approach allows us to specify any combination of controls and resistance mechanisms. The controls cause a specified kill rate(s) on specified vector(s). The resistance mechanisms specify which controls they apply to and how fast resistance increases and decreases in the presence and absence respectively of that control. Cross resistance can be specified simply by specifying multiple controls for one resistance mechanism.

The relationships between vectors, controls and resistance mechanisms are specified in simple configuration files. Here is a simple example of a collection of such configuration files :

places.csv

```
## place_id place_name place_desc vector_id emergence
## 1 dry1 NA vectors only when wet an_gamb 6:0.1;6:0.9
## 2 swamp1 NA vectors all year an_gamb 1
```

vectors.csv

```
## vector_id vector_name vector_desc vector_survival
## 1 an_gamb Anopheles gambiae NA 0.7
```

controls.csv

```
## control_id control_name control_desc vector_id control_kill_rate
## 1 irs_pyr IRS pyrethroid NA an_gamb 0.4
## 2 irs_ddt IRS ddt NA an_gamb 0.5
## 3 irs_ops IRS organophosphates NA an_gamb 0.3
## 4 llin_pyr pyrethroid bednet NA an_gamb 0.2
```

resistances.csv

```
## resistance_id resistance_name control_id
## 1 met_pyr_ddt metabolic pyrethroids and ddt irs_pyr
## 2 met_pyr_ddt metabolic pyrethroids and ddt llin_pyr
## 3 met_pyr_ddt metabolic pyrethroids and ddt irs_ddt
## resistance_strength resistance_incr resistance_decr
## 1 1.0 0.20 0.1
## 2 1.0 0.05 0.1
## 3 0.9 0.20 0.1
```

control_plan.csv

```
## t_strt t_stop control_id
## 1 1 10 irs_pyr
## 2 11 20 irs_ops
```