Design and Assessment of water-energy-food-environment Mega-Systems

Contested baselines and transboundary water resources management: illustrations from the Nile

Dale Whittington[1]

[1]University of North Carolina, Chapel Hill, US

Dale_Whittington@unc.edu

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Abstract
The effect of a proposed or planned policy intervention is estimated using a performance indicator that is associated with the difference between 1) a state of the world without the policy intervention and 2) a state of the world with the policy intervention. Because the effects of most policy interventions play out over time, this *ex ante* comparison requires a forecast of the state of the world without the policy intervention (the ‘dynamic baseline’). This paper identifies three types of problem that policy analysts confront in specifying the dynamic baseline, and their importance for negotiations on managing transboundary water resources: 1) ‘unexamined baselines’; 2) ‘uncertain baselines’; and 3) ‘contested baselines’. The paper focuses on the third problem – contested baselines. If dynamic baselines are contested by stakeholders, controversy over the outcome of a policy analysis may result primarily from different ethical or political assessments of the appropriate choice of the state of the world without the policy intervention. The current controversy over the Grand Ethiopian Renaissance Dam (GERD) on the Nile River is used to provide an example of contested baselines and their potential importance in understanding disagreements about policy interventions involving transboundary water resources.

JEL Codes

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Baselines, Nile, Water Resources, Policy Analysis, Status quo, Do Nothing Alternative

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Two roads diverged in a yellow wood,

And sorry I could not travel both

And be one traveler, long I stood

And looked down one as far as I could

To where it bent in the undergrowth …

From 'The Road Not Taken' by Robert Frost (1915)

1 Introduction

The effect of a proposed or planned policy intervention is estimated using some performance indicator that is associated with the difference between 1) a state of the world without the policy intervention and 2) a state of the world with the policy intervention (Robinson et al, 2019). Just as the traveller in Robert Frost's poem must compare two roads and then choose which to take, a decision maker must compare and then choose between two or more states of the world.[1]

Because the effects of most policy interventions play out over time, this comparison requires a forecast of the state of the world without the policy intervention (the 'dynamic baseline'). This forecast of the dynamic baseline means the policy analyst must look down the 'road not taken' as far as one can see – or until the effects of the policy intervention on the dynamic baseline are no longer significant.

This paper identifies three types of problem that policy analysts confront in specifying the dynamic baseline, and their importance for negotiations on managing transboundary water resources. The first ('unexamined baselines') results from the failure of stakeholders to understand the need for a dynamic baseline.[2] The second is a failure of stakeholders to agree on how to account for uncertainties in the forecast of the dynamic baseline ('uncertain baselines'). The third is a failure of different stakeholders to agree on the dynamic baseline because of disagreements over whether an extension of status quo conditions provides a reasonable or fair basis from which to forecast the dynamic baseline ('contested baselines').

My focus in this paper is on the third problem – contested baselines. If dynamic baselines are contested by stakeholders, controversy over the outcome of an *ex ante* policy analysis may result from different ethical or political assessments of the appropriate choice of the state of the world without the policy intervention, not from differences of opinion about the magnitude of the treatment effect that will result from the policy intervention or parameter values used for the estimation of the treatment effect.[3] I use the current controversy over the Grand Ethiopian Renaissance Dam

[1] Different types of policy analyses use different performance indicators for this comparison. For example, benefit–cost analysis estimates the 'net benefits' associated with a change in two states of the world. Cost-effectiveness analysis estimates a ratio of some outcome indicator (eg lives saved) per dollar spent associated with the change resulting from the implementation of a policy alternative. However, all policy analyses using a consequentialist or teleological ethic to choose the best policy alternative depend on such a comparison of two or more states of the world.

[2] If the policy alternative only has very short-term effects, a dynamic baseline may not be required; status quo conditions may be sufficiently accurate as a comparator. However, the management of transboundary water resources typically requires a long planning horizon, and a dynamic baseline is necessary.

[3] For example, in a benefit–cost analysis the discount rate is often a parameter that affects the estimate of the net benefits of shifting from the dynamic baseline to a new state of the world with the policy intervention.

(GERD) on the Nile River to illustrate this concept of 'contested baselines' and to provide a concrete example of their potential importance in understanding disagreements about policy interventions in transboundary water resources. I conclude with three messages about dynamic baselines for policy analysts working on transboundary water resources.

2 Background

Policy analysts have long understood the need for a dynamic baseline for both *ex ante* and *ex post* assessment of interventions. Economists conducting *ex ante* benefit–cost analyses have included the task of predicting baseline conditions in their guidance documents and have recognised that these forecasts will be uncertain (see Robinson et al, 2019; US Department of Health and Human Services, 2016; US Environmental Protection Agency, 2010). However, many benefit–cost textbooks and guidance documents have paid only minimal (if any) attention to the issue of forecasting the dynamic baseline, and to the best of my knowledge none has clearly identified the problem of contested baselines.

Environmental scholars who study the practice of environmental impact assessment (EIA) and environmental risk assessment have also recognised the importance of baselines in understanding the effects of environmental policy interventions (Hilborn & Walters, 1981; Pauly, 1995, 2019; Knowlton & Jackson, 2008; Aagaard, 2011; Alagona et al, 2012; Craig, 2014; Bento et al, 2016; Ureta, 2018; Barandiarán, 2020; Braverman, 2020; Kinchy, 2020; Ureta et al, 2020). They have also made the important distinction between a 'baseline' that is a component of an EIA, and 'baselining', the bureaucratic, political and social practices that are used to produce or create an environmental baseline (Ureta, 2018). These scholars work in numerous disciplines (ecology, biology, law, sociology, geography) and their interest in the use of environmental baselines has focused primarily on two types of evaluations. The first is an *ex ante* comparison of (1) baseline environmental conditions without a policy intervention, with (2) a new state of the world with the proposed policy intervention. In this comparison, the static baseline is a 'snapshot in time' before the intervention. Barandiarán (2020) describes this baselining process as documenting 'what is there'.

The second type of evaluation is an *ex post* calculation of an environmental loss and involves a comparison of current degraded environmental conditions that have resulted from, for example, an existing polluting activity (status quo condition) with a baseline condition where the polluting activity does not exist. Practitioners of EIAs have argued that status quo or current conditions outside the project area may not be good baselines for the assessment of 'restoration efforts' and have looked back in time to find appropriate historic benchmarks for natural habitats. Often they have tried to define 'natural' or 'undisturbed' conditions as both a reference baseline and a desired state of the world from which to measure the detrimental impact of a polluting activity or development (McClenachan et al, 2006; Bonebrake et al, 2010; Ureta et al, 2020).

But scholars have pointed out that looking back into the past can be problematic. Pauly (1995, p 430) introduced the notion of the 'shifting baseline' in the context of fisheries, which he described as a process by which each new generation of fishery scientists 'forgets' what past fishery stocks were like before they started their career, and thus recalibrates what is natural or considered normal. He argued that through this process we have forgotten how abundant marine fisheries were in the past. Braverman (2020) gives an example of a shifting baseline from the study of the bleaching of coral reefs as a result of global warming. Scientists realised that what they understood to be a healthy reef today would have been a depleted reef in the recent past. Pyle (2003) described the problem of the shifting baseline as the 'extinction of experience'.

Although both types of evaluation necessitate an estimate of an environmental baseline, neither comparison requires the analyst to forecast a dynamic baseline without a policy intervention, my focus in this paper. The problem of the shifting baseline looks to the past to establish a baseline from which to assess damage, not to the future to determine *ex ante* the benefits and costs of a proposed or planned intervention.

3 Three challenges in specifying the dynamic baseline

3.1 Unexamined baselines

The identification revolution in economics has focused economists' attention on something that physical and life scientists have long understood: the importance of accurately identifying the proper counterfactual (Angrist & Pischke, 2010; Banerjee & Duflo, 2009). In a randomised controlled trial (RCT), the controls are allowed to evolve without the intervention for the duration of the experiment, and thus provide the dynamic baseline against which the change in one or more performance indicators or outcome metrics is measured. As public health scientists and later economists took RCTs out of the laboratory and into the field, the proper specification of the dynamic baseline became more challenging, both politically and ethically, especially when the target of the intervention was human subjects. Some stakeholders question the need for a counterfactual in such situations. A central concern has been the withholding of the intervention from control subjects when the presumption is that the treatment will be effective but the magnitude of the treatment effect is unknown. One solution sometimes deployed has been to give the controls something else of similar value to the intervention that is being withheld (Quinn et al, 2019).

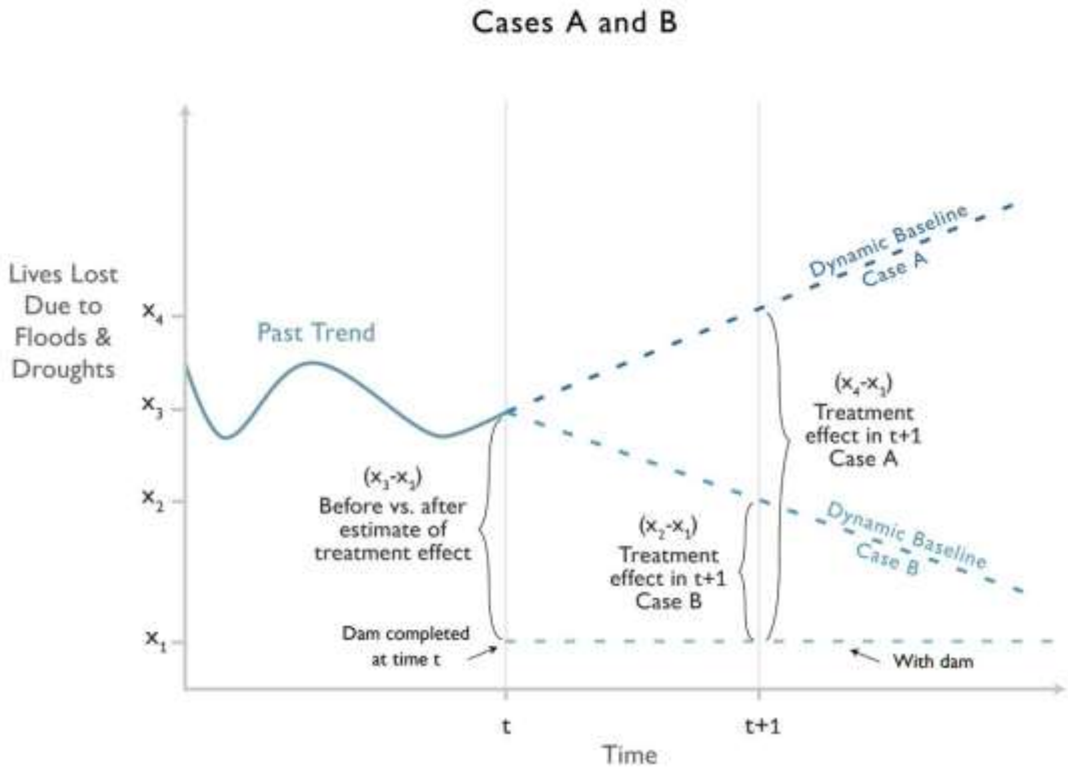
For many types of policy problems, it is not possible to conduct an RCT to test the effectiveness of an intervention. The construction of a dam is an obvious example. Even if there were two identical rivers, one could not practically or ethically build a dam on one river and withhold a dam on the other (control) river to test the effectiveness of an investment in a dam. In such situations the policy analyst needs an analytical model to estimate *ex ante* how a system would evolve with and without the proposed policy intervention.[4] However, stakeholders often fail to recognise the importance of forecasting the dynamic baseline. They may be satisfied with a simple comparison of two states of the world: before and after the construction of a dam. Nevertheless, the need for a counterfactual remains an essential component of a sound evaluation strategy (Aldy, 2014; United States Department of Health and Human Services, 2016).

Figure 1 illustrates this case of unexamined baselines. Suppose there is an unregulated river with a history of past floods and droughts that cause loss of lives. Before time t there is no dam on the river. If a dam were built and completed at time t, the loss of lives from floods and droughts would be reduced in the future.[5] The magnitude of this reduction in lives lost in time t+1 is shown in the figure. Using a before-and-after comparison, this change in the number of deaths thanks to the construction of the dam is measured by the size of the shift in the past trend line and the new

[4] For *ex post* evaluations a variety of non-experimental methods, such as synthetic controls, are available for the construction of the dynamic baseline, even if there is only one (or a few) treated units (Abadie, 2021).
[5] For simplicity, Figure 1 shows the lives lost after the construction of the dam to be constant. This need not be the case. Technological innovation, population and economic growth, and climate change could cause lives lost to rise or fall after time t.

situation after construction (shown as the before-versus-after 'treatment effect' with a magnitude [$x_3 - x_1$] in Figure 1).

Figure 1: Forecasting the dynamic baseline



Such an 'interrupted-times-series' analysis of before and after conditions may be compelling to some stakeholders but it ignores the question of what would have happened if the dam had not been built. Suppose in the dynamic baseline that the number of lives lost as a result of floods and droughts grew over time as a result of population growth and urban expansion. In this case the dam would be more valuable than the before-versus-after analysis indicates. This is shown in Figure 1 (Case A) as a forecast of the dynamic baseline in which deaths increase over time.[6] Thus the benefits of the dam would be underestimated in time t+1 by a before-versus-after comparison that fails to examine the dynamic baseline in the policy analysis (unexamined baselines).

In both benefit–cost analysis and cost-effectiveness analysis, the discounting of future streams of changes in performance indicators may obscure the dynamic baseline. Cost-effectiveness analyses are especially susceptible to this problem of unexamined baselines, because the outcome measure of a cost-effectiveness analysis is a ratio that reports a change in the performance indicator (PI) per dollar spent, ie, ∆PI/$.[7] Because the numerator of the cost-effectiveness ratio is a change in the performance indicator, a dynamic baseline is required to calculate this change. In each future period of the analysis, there is a difference between the dynamic baseline and the forecast of the state of the world with the policy intervention. This time stream of differences is typically discounted back to obtain a present value of the changes in the

[6] This might occur because the dam encouraged settlement below the dam and increased the number of people at risk from the release of excess flood waters or dam failure.

[7] Sometimes a cost-effectiveness measure is reported as the inverse of this ratio, ie the number of dollars required for a unit change in the performance indicator, $/∆PI. In this case the dynamic baseline is hidden in the denominator of the ratio.

performance indicator. This present value is then divided by the cost of the intervention to obtain the cost-effectiveness ratio. Because of this two-step transformation of the differences between the dynamic baseline and the state of the world with the policy intervention (ie discounting the differences and then division by the costs), the dynamic baseline that is used in the cost-effectiveness calculation may be less apparent, or 'hidden in plain sight'.

3.2 Uncertain baselines

In formal decision analysis, the dynamic baseline is an exogenous possible future. There are typically many uncertain states of the world, and decision makers compare the outcomes in the state of the world with the policy intervention to outcomes in these exogenous possible futures. However, forecasts are always uncertain (Schlee & Smith, 2019). The dynamic baseline will be affected by numerous factors that will occur in the absence of the policy intervention, eg population and economic growth, demographic changes, climate change, technological innovation and rural-to-urban migration. Analysts may have honest differences of opinion about the importance and magnitude of such drivers of change in the absence of the policy intervention under consideration.

For instance, a forecast of the number of lives lost as a result of floods and droughts in a river basin may show a decrease from status quo conditions thanks to a more optimistic assessment of technological innovations in early warning systems for floods and droughts, and an estimate of higher rural-to-urban migration that would lead more people to move out of harm's way. This is shown in Figure 1 (Case B) as a forecast of the dynamic baseline in which deaths decrease over time. In this case the change in the number of lives lost because of the dam at t+1 is [x_2 – x_1], which is less than the change in the before-and-after comparison [x_3 – x_1].

Which forecast an analyst chooses (Case A or Case B in Figure 1) to use for the comparison with the state of the world with the policy intervention will affect the estimate of change in the performance indicator. As shown in Figure 1, in time t+1 it could be either [x_4 – x_1] or [x_2 – x_1], depending on which forecast of the dynamic baseline is used for the *ex ante* policy analysis.

For an *ex ante* evaluation of a dam investment, the effect of the dam will usually be estimated as a comparison of alternative runs of a river basin simulation model: 1) a simulation without the dam (the dynamic baseline); and 2) a simulation with the dam (Blackmore & Whittington, 2008; Basheer et al, 2021). If different forecasts of the dynamic baseline have different hydrological characteristics arising, for example, from different assessments of the effect of climate change on a river's hydrology, then the magnitude of the treatment effect (ie the ability of the dam to control hydrological fluctuations) will change depending on the dynamic baseline selected. In other words, the dam could be more or less valuable depending on one's forecasts of how climate change affects future flows of the river (Jeuland & Whittington, 2014).[8]

One approach to dealing with uncertainty in forecasts of the dynamic baseline is to do sensitivity analyses with different baselines – similar to the one-way and Monte Carlo sensitivity analyses now commonly used in benefit–cost analysis for uncertainty in parameter values (Boardman et al, 2018; Jeuland & Pattanayak, 2012). The use of stochastic hydrological methods in river basin simulation models is another approach for dealing with uncertainty in the dynamic baseline (Fiering & Jackson, 1991; Farmer & Vogel, 2016).

The reports of the Intergovernmental Panel on Climate Change (IPCC) provide scenario analyses of carbon dioxide emissions and temperature change in the absence of mitigation efforts. The

[8] New approaches may be required for thinking about decision making under deep uncertainty (Lempert et al, 2013).

IPCC reports then show the effect of different policy interventions (mitigation efforts) on performance indicators such as greenhouse gas emissions or temperature change relative to these multiple dynamic baselines. These IPCC scenario analyses provide an example of how to display and communicate uncertainty in forecasts of the dynamic baseline (IPCC, 2021).[9] However, the use of any of the different types of sensitivity analyses to deal with uncertainty in forecasts of the dynamic baseline is still relatively rare in practice in most policy analyses.

3.3 Contested baselines

Another challenge in the specification the dynamic baseline arises not from uncertainty in the forecast, but from disagreement over the legitimacy or fairness of status quo conditions. Such disagreement can arise because of one stakeholder group's feelings of past injustices and their resulting perception of unfair or inequitable resource allocation in the status quo conditions. Kinchy (2020) uses the term 'contentious baselines' to describe baselines that are controversial and notes that some groups in a controversy may benefit by fostering 'strategic ignorance' about the appropriate baseline to use in an analysis (Lind et al, 2019). Ureta (2018) notes that the choice of the appropriate baseline may involve power struggles among parties.

In this paper I use the term 'contested baselines' to refer to dynamic baselines on which the parties or stakeholders cannot agree when considering the future evolution of conditions.[10] Ideally, a policy analyst evaluating a possible investment in a dam would have an analytical model and a set of assumptions to use to forecast the dynamic baseline mutually agreed upon by the stakeholders. However, in a rapidly evolving, complex political environment, such an analytical model may not be available. Even if such a model exists, there may be no agreement on its acceptability or on the assumptions to be used to forecast the dynamic baseline.[11] In such a situation, some stakeholders may have information or intuition about other policy interventions that could occur in the dynamic baseline. Whether these alternative policy interventions are exogenous may be ambiguous to some or all stakeholders. They may decide to include them in the dynamic baseline and deal later with the political feasibility of influencing a policy intervention assumed to be embedded in the dynamic baseline. Including an alternative policy intervention in the dynamic baseline could be a politically strategic decision. In other words, a stakeholder may know how this choice will influence the comparison of the state of the world with the intervention and the dynamic baseline with embedded alternative policy actions. But a stakeholder may also perceive this possibly endogenous dynamic baseline as the most likely counterfactual.

[9] Careful consideration of uncertainty in the forecast of the dynamic baseline also focuses attention on what is known or being assumed about the magnitude of the treatment effect. Is the magnitude of the treatment effect estimated as 1) a percentage change in the value of the performance indicator in the dynamic baseline; or 2) an absolute magnitude change over a specified baseline? If the treatment effect is estimated as a percentage change in the dynamic baseline, then the size of the change will be dependent on the specific forecast of the dynamic baseline. If it is measured as an absolute magnitude, then it may be possible to apply this estimate to different forecasts of the dynamic baseline. Which approach to use is an empirical question and context-specific. For most RCTs, the treatment effect is typically reported as a percentage point change in the performance indicator between the treatment and controls, not as a percentage change in the dynamic baseline. Whether this percentage point change can be applied to another baseline is a question of the external validity of the experimental results.

[10] I thus make a distinction between 'contested baselines' and Kinchy's notion of 'contentious baselines'. 'Contested baselines' refers to disputes over future dynamic baselines; Kinchy's notion refers to disputes over past or status quo conditions.

[11] Conceptually endogenous policy decisions could be incorporated into the dynamic baseline in such an analytical model, but policy analysts typically avoid this approach because it is so challenging. However, stakeholders may not be able to avoid confronting this complexity.

In Figure 1 the Case A dynamic baseline shows a future state of the world in which past trends evolve and conditions worsen, ie the lives lost as a result of flooding and drought increase. If one stakeholder group perceives this deterioration in future conditions to be partly a continuation of 'bad behaviour' by another party, then the Case A dynamic baseline may be rejected as an appropriate counterfactual because it implicitly assumes that this bad behaviour is allowed to continue in the future. One way to understand this problem of 'contested' baselines is that one party believes that a prior policy change is needed before the policy intervention under consideration can be properly evaluated.[12] In effect, this party is arguing that a different policy mix should be evaluated: a change in the status quo conditions plus the intervention. However, in a rapidly moving political environment, some stakeholders may prefer a dynamic baseline with embedded policy decisions, possibly as a heuristic device. They may not perceive or have time to discriminate between an exogenous dynamic baseline without alternative policy decisions and an array of different combinations of policy options. Thus, the dynamic baseline with possibly endogenous alternative policy options embedded in it can become the main counterfactual. Such an endogenous dynamic baseline may be contested by other stakeholders.

Returning to the example of a proposed dam, the benefits and costs of a new dam will depend on the existing pattern of water use in the basin. For example, some irrigated areas may be short of water and the new dam may provide an increase in the quantity and reliability of water to them. Because of climate change, these status quo conditions may perhaps get worse without the dam, but from the perspective of these irrigators, the dynamic baseline logically should start with these initial conditions.

However, another group of stakeholders may perceive the existing pattern of water use to be unfair and inequitable. From this perspective, the dynamic baseline should not assume that these inequities will continue. This second party may argue that the dynamic baseline should assume a different, more just resource allocation, and that the policy intervention should be assessed relative to this new pattern of water use.

For example, many Tribes in the southwestern US feel that their water resources have been usurped by non-Native American irrigators and urban water users. Tribes believe that this status quo condition is unfair and should be rectified. Future interventions such as climate mitigation and adaptation measures should be evaluated once this inequitable distribution has been addressed.

Tribes in the US view themselves as sovereign entities within the national borders of the state, and a reallocation of water resources from non-native irrigators to a Tribe is similar in some respects to a transboundary water resources conflict. If one looks at this reallocation through the lens of international water law and applies the principles of 'no significant harm' and 'equitable use', the measurement of 'significant harm' presents a difficulty. This is because the dynamic baseline is contested. There is no agreement on the reference condition from which significant harm should be measured.

[12] Conceptually this problem of contested baselines is similar to the use of 'hypothetical baselines' in stated preference (SP) studies, in which respondents are provided with a description of a baseline that is intentionally not the actual state of environmental quality, health or other baseline condition. The SP researcher then poses a valuation question or choice task that is contingent not on the existing status quo, but rather on the state of the world described in this new hypothetical baseline (Whittington & Adamowicz, 2011). Just as with contested baselines, there may be disagreements among respondents on the appropriate specification of the hypothetical baseline in an SP survey as a result of perceived inequalities in the status quo conditions.

From the perspective of the non-native irrigator, the reallocation of water to a Tribe will be experienced as a welfare loss which should be measured by the minimum compensation that the irrigator would accept to make them as well off as if the reallocation had not occurred (Table 1). Because people value welfare losses much more than gains, from the irrigator's perspective the 'appreciable harm' resulting from the water reallocation could be very large. From the perspective of the non-native irrigator, the benefits of the water reallocation should be measured by the Tribe's willingness to pay (WTP) for the water.

Table 1: Measuring 'no significant harm' in the presence of contested baselines: a water reallocation from a non-native American irrigator to a Native American Tribe

How should welfare change be measured from the perspective of …	Welfare loss to non-native irrigator	Welfare gain to Tribal members
Non-native irrigator	WTA compensation to incur loss of water	WTP for increased water supply
Tribe	WTP to avoid a loss of water	WTA compensation to forego the increase in water supply

Notes: WTA = willingness to accept (compensation); WTP = willingness to pay.
For many types of interventions, WTA measures of welfare changes are approximately three times WTP measures.

However, from the Tribe's perspective, the irrigator's welfare loss is a reduction in an unjust or even illegal gain. Any estimate of significant harm that the non-native irrigator experiences should be valued much less than the minimum compensation that the irrigator would accept to make them as well off as if the reallocation had not occurred. Similarly, from the Tribe's perspective, the welfare gain from reallocating water to the Tribe should be valued as a reduction in a loss, not as a gain from the current status quo conditions. This welfare gain should be measured as the minimum compensation the Tribe would accept not to have the reallocation occur. In this example, the willingness-to-accept (WTA) measure would be much higher than the amount the Tribe would be willing to pay for the water.

Thus, the two parties have different baselines from which to measure significant harm. The non-native irrigator views the dynamic baseline as a continuation of the current status quo conditions in which they hold the water rights. The Tribe views the dynamic baseline as a situation where past injustices have been rectified. From a welfare economics perspective, these different dynamic baselines imply that the parties would use different welfare measures to assess the significant harm to the non-native irrigator and the welfare gain to the Tribe resulting from the water reallocation.[13]

4 Nile illustrations – contested baselines

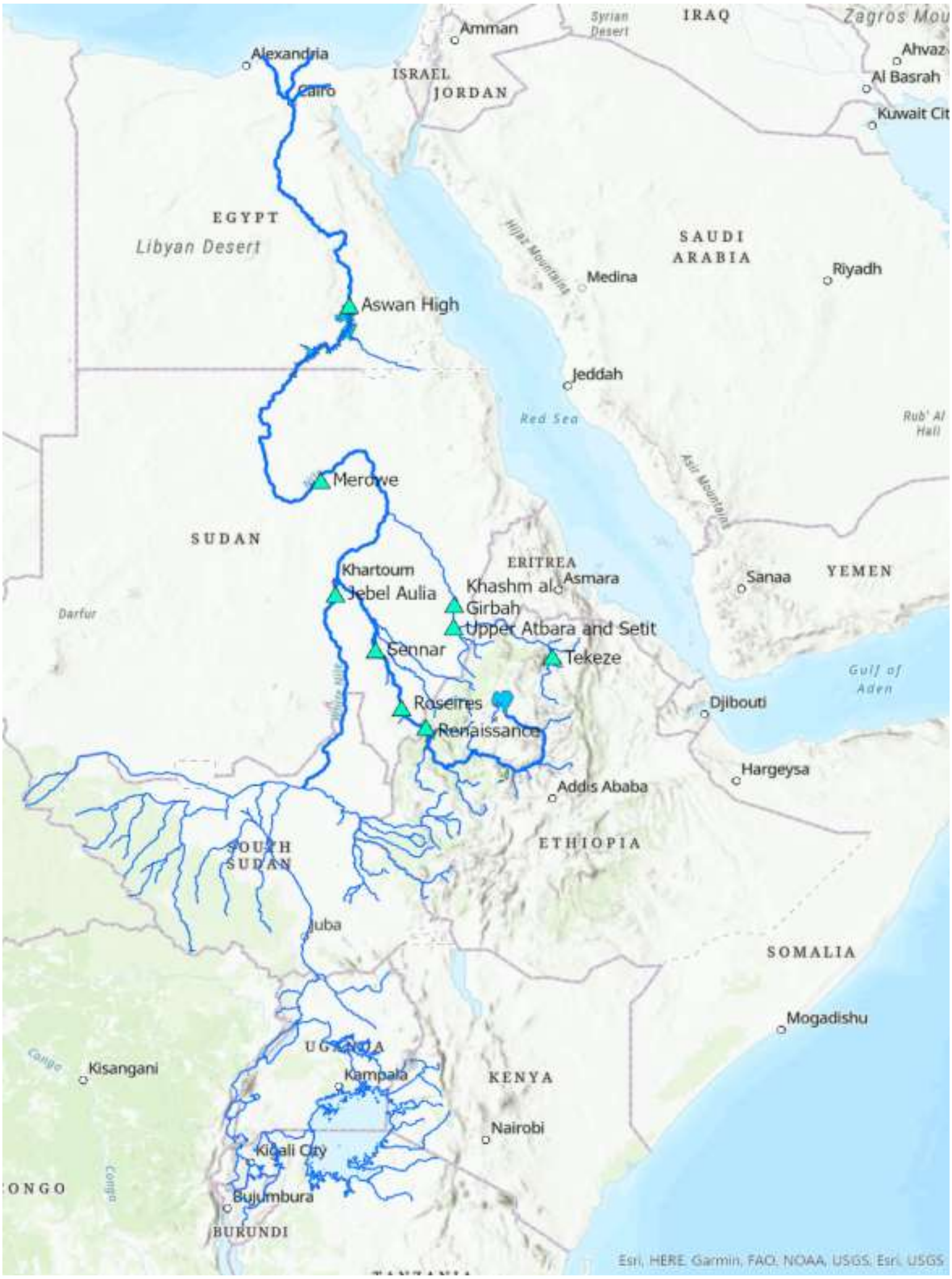
4.1 Background

In March 2011 Ethiopia announced that it would build a large hydroelectric dam (subsequently named the GERD) on the Blue Nile near the Sudanese–Ethiopian border (see Figure 2). In 2008 the report of the Scoping Study Team to the Eastern Nile Council of Ministers had recommended that investments in storage should begin on the Blue Nile in Ethiopia (Blackmore & Whittington,

[13] Knetsch (2020) refers to both the WTA measure to value a loss and the WTA measure to value a gain that is viewed as a reduction in a loss as 'the domain of losses'. See also Nguyen et al (2021).

2008), but Egyptian policy makers disagreed with this conclusion and argued that investments on the White Nile were more attractive. Even among planners who favoured infrastructure development on the Blue Nile, there was no consensus on the size and location of such investments. Thus Ethiopia's unilateral decision to construct the GERD caught Egypt and Sudan, as well as the international community, by surprise.

Figure 2: The Nile basin with the location of the GERD (shown as 'Renaissance')



Ethiopia began construction of the GERD immediately after its announcement, without the independent engineering, economic, environmental and social impact studies that would have been required if international financing had been involved. In November 2011, Ethiopia agreed to form an International Panel of Experts (IPoE) with two representatives from each of the Eastern Nile riparian countries (Ethiopia, Egypt and Sudan) and four international experts to investigate the existing plans for the GERD and the impacts of the dam. The IPoE (2013) issued its report in May 2013, but many questions about the GERD remained unresolved, including policies for both filling and operating it.

In 2014 the three countries agreed to establish a Tripartite National Committee composed of representatives from the three Blue Nile riparians to address questions raised by the IPoE about the impacts of the GERD. The plan was for the Tripartite National Committee to hire and jointly supervise an international consulting firm to conduct these studies. The Tripartite National Committee issued a Request for Proposals and eventually the contract was awarded to two French firms – BRL Ingénierie (BRLi) and Artelia.

4.2 Contested baselines – Nile example 1: GERD impact studies

The studies by BRLi and Artelia were never completed, because Ethiopia and Egypt could not agree on the baseline from which to measure the hydrological, environmental and economic impacts of the GERD.[14] The construction of the dam and its filling and operation will change the hydrology of the Nile downstream, essentially eliminating the flood in Sudan on the Blue and Main Nile, improving both hydropower generation and irrigation in Sudan, and eventually generating roughly 15,000 GWH of electricity in Ethiopia annually (Basheer, 2021; Wheeler et al, 2020).[15] However, if a prolonged multi-year drought were to occur during the filling period, Egypt could suffer irrigation deficits and thus economic losses, depending on the filling and operating rules for the GERD. But from what baseline conditions should such losses to Egypt be measured?

For Egypt the answer was obvious: the changes resulting from the construction and operation of the GERD should be measured relative to a continuation of the status quo conditions before the dam was built. The 1959 Nile Waters Agreement between Egypt and Sudan defined the legal status quo and allocated an assumed mean annual flow of 84 billion cubic metres (bcm) measured at Aswan between Egypt (55.5 bcm) and Sudan (18.5 bcm), with 10 bcm assumed to be lost to evaporation from the Aswan High Dam Reservoir (AHDR) (Whittington et al, 2014). Ethiopia was not a party to the 1959 Nile Waters Agreement and always objected to being left out of this bilateral allocation of Nile waters.

In the Tripartite National Committee, Egypt argued that the existing Egyptian and Sudanese uses of Nile waters were simply a fact, and that the purpose of the BRLi and Artelia study was to measure the economic, environmental and social changes that would result compared to a continuation of status quo conditions. From Egypt's perspective, the baseline without the GERD was uncontroversial, and there was no alternative dynamic baseline available to the French

[14] There was also disagreement between Egypt and Sudan over the appropriate baseline. Egypt argued that the baseline should be based on current water use. Sudan felt that the dynamic baseline should be based on the water allocations in the 1959 Nile Waters Agreement, because it was not yet using its full water allocation under the treaty.

[15] Sudan has two main concerns about the construction and operation of the GERD. First, the elimination of the Nile flood would essentially eliminate most of the remaining recession agriculture along the Nile in Sudan. Second, the coutnry needs timely information on the operating policy of the GERD in order to better operate its downstream dams, especially Roseires.

consultants from which to measure the dam's impacts. Egypt was especially concerned about its ability to continue to release 55.5 bcm annually from the Aswan High Dam and argued that any irrigation deficits that might result during a prolonged multi-year drought should be measured from this target release that was codified in the 1959 Nile Waters Agreement.

Since Ethiopia had never agreed to Egypt's and Sudan's allocations in the Nile Water Agreement, it did not agree that the French consultants should calculate any Egyptian irrigation deficits as a shortfall from 55.5 bcm. From Ethiopia's perspective, if Egypt were to release, say, only 50 bcm during a drought, this was still the lion's share of the Nile flow. From Ethiopia's perspective, the difference of 5.5 bcm from what Egypt wanted should not be perceived as a 'deficit' because the 55.5 bcm baseline was itself illegitimate. Ethiopia feared that accepting a continuation of current water uses as the dynamic baseline would confer legitimacy on the 1959 Nile Waters Agreement and preclude future water use in Ethiopia upstream of the GERD.

Ethiopia could have proposed a different dynamic baseline and then measured the impacts of the GERD relative to this hypothetical or alternative water allocation. However, to the best of my knowledge, it never did so. Egypt and Ethiopia never reached a resolution of this problem of the contested baseline. Without an agreed upon dynamic baseline, the French consultants could never start the impact assessment work specified in their terms of reference, and the consultancy was abandoned.

4.3 Contested baselines – Nile example 2: a proposal for cooperative filling and management of the GERD

Despite the inability of the Tripariate National Committee to oversee the GERD impact studies, construction of the GERD continued. Attention increasingly focused on the filling and operation of the dam (Wheeler et al, 2016). At the 2018 Cairo Water Week conference, Karol Heijnert from the Dutch consulting firm Deltares gave a presentation in a session entitled, 'Transboundary Water Governance and Benefit Sharing' in which he shared some of the insights from Deltares' work for Egypt on the impacts of the GERD (Heijnert, 2018).[16] Heijnert "strongly advised" against filling the GERD in a fixed period of years regardless of the inflows to the GERD. He termed this a "non-cooperative strategy" and said that this was not a wise approach because it could result in severe water shortages in Egypt, ie it could cause "significant harm".

Instead, he argued for "cooperative" or "adaptive" filling strategies. Heijnert listed three possible components of a "cooperative filling strategy": 1) filling the GERD with a fixed percentage of the annual inflow to the dam; 2) maintaining a minimum outflow from the GERD; and 3) maintaining a minimum level in the ADHR. He described the third component as the "most cooperative" because "it is really important for Egypt to have sufficient water in Lake Nasser to irrigate the country". He argued that "if you apply the right [cooperative] filling strategy", average hydrological conditions would not cause problems in Egypt because the country would be able to continue to release its 55.5 bcm allocation under the 1959 Nile Waters Agreement.

From the perspective of the conceptual framework depicted in Figure 1, Heijnert assumed a dynamic baseline that was largely a continuation of status quo conditions in which Egypt would be able to release 55.5 bcm in all but the most extreme drought conditions. The intervention to be assessed relative to this dynamic baseline was the construction of the GERD. If Ethiopia followed a

[16] Deltares does water resources modelling work throughout the Nile basin, indeed throughout the world, and has had a long relationship working with Egypt on Nile water management issues.

non-cooperative GERD filling strategy, such as filling in a fixed number of years, this intervention could result in severe water shortages in Egypt if filling occurred during a multi-year drought.

However, Heijnert argued that, if Ethiopia adopted a cooperative filling strategy and released water from the GERD to maintain a minimum level of the AHDR, this would enable Egypt to largely return to the conditions in the dynamic baseline in which water shortages were rare. He acknowledged that this cooperative strategy would result in hydropower losses to Ethiopia but argued that these would be much less than the economic benefits to Egypt of avoiding water deficits measured from a target release of 55.5 bcm (conceptualised as a WTP measure of welfare loss, not as the minimum compensation Egypt would accept to incur the loss).

In 2019 Egypt made a proposal (the 'Egyptian Proposal for Technical Aspects of the Agreement on the Filling and Operation of the Grand Ethiopian Renaissance Dam') for operating and filling the GERD that included several of these elements of a cooperative filling strategy. It specified a minimum annual release from the GERD of 40 bcm (except during drought conditions) and that the level of the AHDR be maintained at 165 metres above sea level (masl) during the filling of the GERD. The Egyptian proposal also introduced the concepts of 'natural flow' and 'average natural flow' at the GERD site and specified that Egypt and Ethiopia should share equally the difference between the natural flow and the average natural flow to refill the two reservoirs after a prolonged drought. The Egyptian proposal required that Ethiopia use the GERD's 'Strategic Reserve' storage between 595 masl and 617 masl (about 21 bcm) to supplement flows to Egypt during drought conditions, thus reducing Egyptian water deficits, as Heijnert had advocated.

From Egypt's perspective this was an equitable, balanced proposal, but it was based on the assumption that a filling and operating strategy for the GERD should be evaluated using a dynamic baseline where status quo conditions would continue into the future. Ethiopian acceptance of the proposed definitions of natural flow and average natural flow based on historical hydrology, and a commitment to share equally the difference to refill the two reservoirs after a prolonged drought, would effectively have precluded Ethiopia's future use of water upstream of the GERD.

Ethiopia rejected this 2019 Egyptian proposal, but the fundamental problem was not the proposal *per se*, but Egypt's assumed dynamic baseline. Ethiopia did not agree that the objective of a cooperative filling and operating strategy for the GERD should be to minimise Egyptian deficits from target releases of 55.5 bcm. This disagreement over the dynamic baseline was the same issue that had halted the work of the French consultants BRLi and Artelia.

Since 2019, the controversy over the GERD has escalated. At the time this paper was written (February 2022) the construction of the dam was still not finished, and Ethiopia had only managed to capture about 8 bcm in the GERD Reservoir, 11% of the ultimate target of 74 bcm (Wheeler, 2022). In July 2021, the representatives of Egypt, Ethiopia and Sudan debated the risks and rewards of the filling and subsequent operation of the GERD before the UN Security Council. Egypt wanted assurances that the GERD's filling and operating policies would not infringe on its historic water use ('no significant harm'); Ethiopia argued that an agreement on the filling and operating policies of the GERD should not restrict its rights to develop and use Nile waters originating on its sovereign territory ('equitable use'). These positions were essentially statements about the countries' contested baselines for implicit visions of future irrigation development in the Nile basin, not only in Ethiopia upstream of the GERD, but also in Sudan and Egypt.

5 Concluding remarks

This discussion of contested baselines highlights three main lessons for stakeholders and consumers of policy analysis working on transboundary water resources management and negotiation. First, disputes over transboundary water resources often focus on the trade-off between the principles in international water law of ‘no significant harm’ and ‘equitable use’. However, the measurement of ‘no significant harm’ requires agreement on a dynamic baseline, which may not exist. Thus, parties may disagree not only about the allocation principle to use to share transboundary water resources, but also about the dynamic baseline to use to make the assessment of ‘no significant harm’. This dilemma is likely to be fairly common in the management of transboundary water resources.

Second, stakeholders and consumers of policy analyses need to develop the habit of searching carefully for both dynamic baseline assumptions and the ‘baselining process’, even if analysts or stakeholders themselves have not made these clear. Any *ex ante* policy analysis that seeks to determine the consequences of a policy intervention must specify a dynamic baseline from which change is measured. However, either for strategic reasons or because of neglect, policy analysts often draw stakeholders’ attention away from the specification of the dynamic baseline.

The two illustrations of the contested baseline controversy from the Nile are unusual because the controversy over the filling and operation of the GERD has revealed the problem of contested baselines so clearly. Typically, the problem of contested baselines is more obscure. Sometimes the dynamic baseline is hidden in plain sight but never mentioned. Sometimes, as in Robert Frost’s poem, the road not taken is hidden in the ‘undergrowth’ of the analysis, as often happens in benefit–cost and cost-effectiveness calculations.

Third, in situations where baselines are contested, stakeholders need to carefully discern the source of the disagreement. Dynamic baselines may be chosen by parties to a conflict for strategic reasons, ie to influence the outcome of a policy analysis. However, the choice of a dynamic baseline may not be strictly instrumental but may also reflect deeply held feelings of fairness and justice. One useful approach would be to undertake the policy assessment with the different dynamic baselines proposed by the opposing parties. Doing the analysis with each party’s proposed baseline may help clarify their differences and open new possibilities for compromise.

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